U.S. Department of Energy
Office of River Protection
Mr. Michael K. Barrett
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CCN: 026381

Dear Mr. Barrett:

CONTRACT NO. DE-AC27-01RV14136 – TRANSMITTAL FOR INFORMATION– INTEGRATED SAFETY MANAGEMENT PLAN PAGE CHANGES FOR AUTHORIZATION BASIS CHANGE NOTICE 24590-WTP-ABCN-ESH-01-011, REVISION 1, "INCORPORATE CHANGES TO REFLECT REVISION OF CONFIGURATION MANAGEMENT PLAN AND COMPLIANCE WITH ISO 10007"

Reference: CCN 026609, Letter, R. C. Barr, OSR, to R. F. Naventi, BNI, "Office of Safety Regulation Response to the Contractor Initiated Changes to the Integrated Safety Management Plan, Per Authorization Basis Change Notice 24590-WTP-ABCN-ESH-01-011, Revision 1," 01-OSR-0510, dated December 18, 2001.

Bechtel National, Inc. (BNI) is submitting to the U.S. Department of Energy (DOE), Office of River Protection, and Office of Safety Regulation (OSR), page changes for the Integrated Safety Management Plan (ISMP), Revision 0d. These page changes incorporate the wording changes that were identified in Authorization Basis Change Notice (ABCN), 24590-WTP-ABCN-ESH-01-011, Revision 1. Specifically, wording has been added back into the ISMP Section 1.3.16 requiring implementation of the Configuration Management Plan for the operations and deactivation phases of the project.

In the referenced letter DOE requested additional wording insertions into the ISMP Section 1.3.16 to restore the commitment that procedures and program changes will be evaluated for degradation of safety and protection of the environment. BNI is working on this response as 24590-WTP-ABCN-ESH-01-011, Revision 2, which will be provided to the OSR in a subsequent transmittal.

An electronic copy of page changes for ISMP, Revision 0d, is provided for the OSR's information and use.

Please contact Mr. Bill Spezialetti at (509) 371-4654 for any questions or comments.

Very truly yours,

A. R. Veirup
Prime Contract Manager

TR/slr

Attachments: Page changes – Integrated Safety Management Plan, 24590-WTP-ISMP-ESH-01-001, Revision 0d

Document title:	**Integrated Safety Management Plan**
Contract number:	DE-AC27-01RV14136
Department:	Environmental, Safety, and Health
Document number:	24590-WTP-ISMP-ESH-01-001, Rev 0d
Date of issue:	28 December 2001
Issue status:	Approved

History Sheet

Rev	Date	Reason for revision	Revised by
0	29 Aug 2001	Supersedes BNFL-5193-ISP-01 Revision 7. Incorporates 24590-WTP-ABCN-ESH-01-017 changes, a WTP contractor-approved change notice.	R Dickey
0a	24 Sep 2001	Incorporated 24590-WTP-ABCN-ESH-01-011 Rev 0 changes (contractor-approved ABCN), and added two acronyms and one reference that were defined in text added by the referenced ABCN.	R Dickey
0b	4 Oct 2001	Incorporates ABCN-24590-01-00006 Rev 0 changes as partially approved by DOE Letter 01-OSR-0311 (CCN 023253) and contractor approved as revised ABCN-24590-01-00006, Rev 1.	R Dickey
0c	27 Dec 2001	Incorporates 24590-WTP-ABCN-ESH-01-023 Rev 0 changes (contractor-approved ABCN).	R Dickey
0d	28 Dec 2001	Incorporates 24590-WTP-ABCN-ESH-01-011 Rev 1 changes (contractor-approved ABCN).	R Dickey

Revision Status

Page No.	Rev	Page No.	Rev	Page No.	Rev	Page No.	Rev
i	0d	1-21	0d	3-22	0b	4-15	0
ii	0d	1-22	0a	3-23	0	4-16	0
iii	0d	1-23A	0d	3-24	0	4-17	0
iv	0d	1-23B	0a	3-25	0	4-18	0
v	0	1-23C	0b	3-26	0	4-19	0
vi	0	1-24	0	3-27	0	4-20	0
vii	0	2-1	0	3-28	0	4-21	0
viii	0	2-2	0	3-29	0	4-22	0
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9-5	0	10-4	0	11-9	0	12-7	0b
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Approved by: _____ _____ Date: _____
(Print name) (Sign)

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Acronyms

AB	Authorization Basis
AIChE	American Institute of Chemical Engineers
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
BNI	Bechtel National, Inc.
CAMS	Corrective Action Management System
CAR	Construction Authorization Request
CFR	Code of Federal Regulations
Ci	Curie
CM	Configuration management
CM Plan	RPP-WTP Configuration Management Plan
DAR	Deactivation Authorization Request
DBE	Design Basis Earthquake OR Design Basis Event
DC&C	Design, Construction, and Commissioning
DCD	Design Criteria Database
DOE	U.S. Department of Energy
DOELAP	DOE Laboratory Accreditation Program
DOE-RL	U.S. Department of Energy Richland Operations Office
DOH	Washington State Department of Health
DWPF	Defense Waste Processing Facility
EAL	Emergency Action Level
Ecology	Washington State Department of Ecology
ECP	Employee Concerns Program
EDSP	Engineering Design Safety Principle
EIS	Environmental Impact Statement
EMP	Emergency Management Program
EMS	Emergency Management System
EP	Emergency Plan
EPA	U.S. Environmental Protection Agency
EPIP	Emergency Plan Implementing Procedure
ER	Environmental Report
ERPG	Emergency Response Planning Guide
ERPP	Environmental Radiation Protection Program
ES&H	Environment, Safety, and Health
FHA	Fire Hazard Analysis
FR	Federal Register
FSAR	Final Safety Analysis Report
HAL	Highly Active Liquids
HAR	Hazard Analysis Report
HAZOP	Hazard and Operability (analysis)
HEPA	High-Efficiency Particulate Air (filter)
HLW	High-Level Waste
HRC	Hazards Research Corporation
Hwy	Highway
ICBO	International Conference of Building Officials
IPT	Integrated Product/Process Team

IRT	Independent Review Team
ISA	Integrated Safety Analysis
ISAR	Initial Safety Analysis Report
ISMP	Integrated Safety Management Plan
ISO	International Organization of Standards
ITS	Important to Safety
LAW	Low-Activity Waste
LWA	Limited Work Authorizations
MSDS	Material Safety Data Sheets
NAICS	North American Industry Classification System
NCRP	National Council on Radiation Protection and Measurements
NPH	Natural Phenomenon Hazard
NRC	U.S. Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OAR	Operating Authorization Request
OPM	Operational Preventive Measures
OSHA	Occupational Safety and Health Administration
PFD	Process Flow Diagram
PHA	Process Hazards Analysis
PHMC	Project Hanford Management Contractor
PSAR	Preliminary Safety Analysis Report
PSC	Project Safety Committee
PSM	Process Safety Management
QA	Quality Assurance
QAM	Quality Assurance Manual
QAP	Quality Assurance Program
QAPIP	Quality Assurance Program and Implementation Plan
QARD	Quality Assurance Requirements and Description
QL	Quality Level
RAMI	Reliability, Availability, Maintainability, and Inspectability
RCRA	*Resource Conservation and Recovery Act of 1976*
rem	Roentgen-Equivalent Man
RG	Regulatory Guide
RL	Department of Energy Richland Operations Office
RMP	Risk Management Plan
RPP	Radiation Protection Program
RPP-WTP	River Protection Project – Waste Treatment Plant
SAR	Safety Analysis Report
SDC	Safety Design Class
SDS	Safety Design Significant
SER	Safety Evaluation Report
SIXEP	Site Ion Exchange Effluent Plant
SNM	Special Nuclear Material
SPD	System Performance Demonstrations
SRD	Safety Requirements Document
SSC	Structures, Systems, and Components
STD	Standard (also Std)

TSR	Technical Safety Requirement
TEDE	Total Effective Dose Equivalent
TWRS	Tank Waste Remediation System
TWRS-P	Tank Waste Remediation System-Privatization
UBC	Uniform Building Code
USC	United States Code
USQ	Unreviewed Safety Question
VPP	Voluntary Protection Program
VSL	Vitreous State Laboratory
WAC	*Washington Administrative Code*
WISHA	Washington Industrial Safety and Health Administration

1.0 Project Safety Approach

The RPP-WTP Contractor's safety approach is implemented with the recognition that the defined work for processing and immobilizing Hanford tank waste involves inherent radiological and chemical hazards from which hazardous situations may arise. The RPP-WTP Contractor is committed to integrating the development of safety criteria and design requirements, the hazard analysis and accident analysis process, and the facility design to minimize the risk associated with these hazards and hazardous situations. The RPP-WTP Contractor accepts responsibility for the safety of the RPP-WTP and for adequate protection of the health and safety of the public, worker safety, environmental protection, and compliance with applicable laws and regulations.

This chapter of the Integrated Safety Management Plan (ISMP) provides an overview of the RPP-WTP design, construction, and commissioning (DC&C) Contractor (i.e., Bechtel National, Inc. [BNI]) safety approach developed for the River Protection Project – Waste Treatment Plant (RPP-WTP). The elements of this approach, through their evolutionary implementation in Part A of the project, form the bases for this ISMP. The ISMP is followed and will be further developed during Part B of the Project for detailed design, construction, operation, and deactivation of the facility.

The Project safety approach is summarized in Section 1.1, "Introduction". The components of the safety approach are described in greater detail in Section 1.2, "Summary". The elements of the safety approach are described in Section 1.3, "Description of the Integrated Safety Management Plan".

1.1 Introduction

The safety management practices outlined in the ISMP have been developed specifically for the Project. The development of these management practices was based on the experience of the Project team at other nuclear facilities in the areas of design, construction, and operation. These practices ensure implementation of the corporate policy that no activities are more important than the health and safety of its workers, contractors, the public, or protection of the environment.

The ISMP documents the process by which laws, regulations, and standards applicable to the nuclear, radiological, and process safety aspects of the Project are incorporated into programs for facility design, construction, operation, and deactivation to ensure adequate safety of workers and the public and protection of the environment. A further role of the ISMP is to demonstrate how practices are in line with the RPP-WTP Contractor policies to ensure that the safety culture achieved at other nuclear chemical facilities can be successfully sustained through the different phases of the RPP-WTP. At this stage in the project, the ISMP is biased towards the design and construction phase, during which most of the processes described are developed. However, the principles of the ISMP for later stages of the facility life through operation and deactivation and how the design and construction phase will be integrated into these later stages is discussed. The ISMP also describes how the safety management practices will be followed and further developed during Part B of the Project.

Table 1-1 BNFL Team Experience Related to the TWRS-P Project (this table has been deleted)

To accomplish its roles, the ISMP describes the following:

1) The facility defined work to process and immobilize Hanford Tank waste in a safe manner (ISMP Section 1.3.1, "Project Initiation")
2) The selection of a safe and proven technology (ISMP Section 3.7, "Proven Engineering Practices")
3) The development and use of the SRD (ISMP Section 1.3.3, "Safety Requirements Document")
    a) To establish the Safety Criteria by which the process hazard analysis (PHA) and accident analysis identify features required for worker and public safety
    b) To identify the design requirements that, when implemented, ensure that prevention and mitigation controls will perform their specified safety functions
4) The use of PHA to identify the full range of potential radiological and chemical hazards and hazardous situations (ISMP Section 1.3.4, "Process Hazards Analysis")
5) The accident analyses performed to identify engineered and administrative controls required for worker and public safety (ISMP Section 1.3.6, "Accident Analysis")
6) The iteration of the PHA, accident analyses, and design to ensure an adequate level of safety for the workers and the public (ISMP Sections 1.3.7, "Acceptable Level of Public Safety" and 1.3.8, "Acceptable Level of Worker Safety")
7) The development of the technical safety requirements, if required, that are based on:
    a) A process variable, design feature, or operating restriction that is an initial condition (i.e., the assumed facility state) for an accident analysis
    b) Structures, systems, and components that must function to maintain compliance with public and worker radiological and chemical exposure standards
8) The development of procedures and training to achieve and maintain the required administrative controls (ISMP Sections 1.3.12, "Training" and 1.3.13, "Procedures")
9) The development of an emergency preparedness program and implementing procedures (ISMP, Section 1.3.18, "Emergency Planning")
10) The assignment of design, construction, and operational roles and responsibilities and the use of assessments to ensure the necessary attributes of the ISMP are effectively accomplished (ISMP, Chapters 10.0, "Assessments", and 11.0, "Organizational Roles, Responsibilities, and Authorities")

Chapter 1.0 of the ISMP presents the BNI safety approach. Chapters 2.0 through 11.0 are formatted to correspond to the attributes included in RL/REG-97-07, *Guidance for the Review of TWRS Privatization Contractor Integrated Safety Management Plan Submittal Package* (DOE-RL 1997).

Throughout the ISMP, lists of items are numbered for the convenience of the reviewers in referring to individual items. The numbering is not an indication of the importance or sequence of the items.

Chapter 12.0, "Definitions", contains the definitions of some of the terms, phrases, or documents that are found throughout the ISMP. When used unmodified in the ISMP, "worker" refers to the facility and collocated worker, both individually and collectively.

Within this document, the *Safety Requirements Document* (SRD) (BNI 2001b and BNI 2001c), *Hazard Analysis Report* (HAR) (BNFL 1997b), *Quality Assurance Program* (QAP) (BNFL 1997a, BNFL 1998c), *Quality Assurance Manual* (QAM) (BNI 2001), and *Initial Safety Analysis Report* (ISAR) (BNI 2001d and 2001e), are cited using acronyms. Full reference information for these documents appears in Chapter 13.0, "References".

1.2 Summary

The Project safety approach is implemented with the recognition that the defined work of processing and immobilizing Hanford tank waste involves inherent radiological and chemical hazards from which hazardous situations may arise. The Project is integrating the development of Safety Criteria, design requirements, the hazard analysis and accident analysis processes, and the facility design to minimize the risk associated with these hazards and hazardous situations. The elements of this approach, through their evolutionary implementation in Part A of the Project, form the bases for this ISMP.

The safety approach for the Project is based on applying best industry practices and cost-effective processes that come from successful and safe operation in the commercial nuclear environment and the chemical process industry. The purpose of the safety approach is to achieve the following objectives.

1) Ensure an adequate level of safety at the facility for the workers and the public.
2) Comply with applicable laws and regulations.
3) Conform to top-level safety standards and principles stipulated by the U.S. Department of Energy (DOE-RL 1996b).

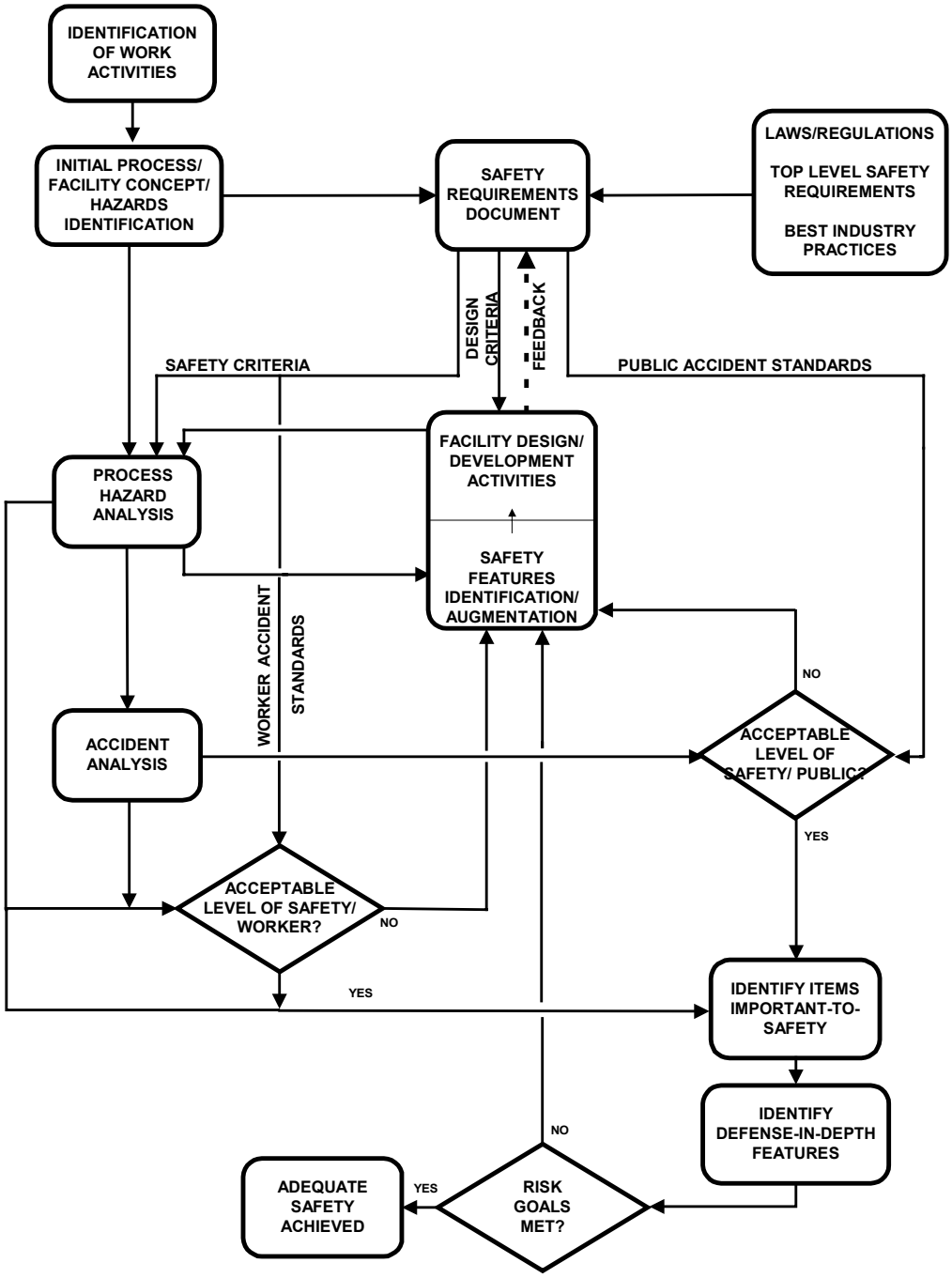
A diagram of the Project safety approach is presented in Figure 1-1. The safety approach begins with the definition of the work to be performed and continues with the development of the conceptual process flow diagrams (PFD) and other facility design information required to accomplish the defined work. The PFDs and design development give consideration to the types of work to be accomplished, the hazards identified for similar facilities, and the methods by which these hazards were previously eliminated or controlled for similar facilities. This conceptual information is used to identify appropriate hazards-based standards and initiate the development of the SRD.

The identification of hazards and hazardous situations helps to characterize the hazardous situations as those that may require prevention or mitigation. The identification and characterization of the hazards and hazardous situations establish a basis for describing approaches and measures to control the hazards. Safety Criteria are then developed that document the set of standards and requirements necessary to ensure implementation of the necessary hazard control strategies. These Safety Criteria are documented in the SRD and are based on applicable laws and regulations, the U.S. Department of Energy's (DOE) top-level safety requirements, and best industry practices. The SRD provides Safety Criteria to the PHA by which an initial assessment of the adequacy of the design is made.

As accident prevention and mitigation safety features are identified in the PHA, the resulting facility design impacts are fed back to the SRD process, as required, for further development of more detailed Safety Criteria and design requirements to ensure all safety features provide their specified safety functions.

As the PHA, PFDs, and facility design mature, accident analyses are performed to confirm judgements made during the PHA and to further characterize the accident scenarios to demonstrate compliance with radiological and chemical exposure standards for accidents. Additional protection for workers is identified by the PHA, the accident analyses, and the application, as appropriate, of Process Safety Management (PSM) required by 29 CFR 1910.110.

Figure 1-1 Project Safety Approach



Significant features of the Project safety approach are described as follows.

1) The approach continually integrates hazard identification, SRD development, design development, and accident analysis throughout the facility design, construction, operation, and deactivation phases.
2) The approach uses the best industry practices that include PHA, a rigorous design process based on a set of credible accidents and a defense-in-depth philosophy, and verification of the level of facility safety through accident analysis and validation of requirements implementation.
3) The PHA identifies and evaluates the significance of potentially hazardous situations. For each identified event, a defense-in-depth approach applies a level of protection in terms of engineered features and administrative controls that is commensurate with the severity of the unmitigated event. The hazards evaluation techniques satisfy the requirements of a hazards analysis process established by the American Institute of Chemical Engineers (AIChE 1992).
4) A conservative approach to accident consequence analysis is used in terms of input assumptions, boundary conditions, and modeling techniques. As the process and facility design mature, the modeling is refined to eliminate unnecessary conservatism. This strategy is consistent with risk-based approaches that allow the use of uncertainty analysis to better identify the impact of assumptions and state of knowledge on results from the safety analyses.
5) The safety approach documents how the identification of the engineered and administrative controls credited for public and worker safety and facility Safety Criteria is accomplished.

This approach to safety analysis is similar to that described in draft NUREG 1513, *Integrated Safety Analysis Guidance Document,* (NRC 1994) published by the U.S. Nuclear Regulatory Commission (NRC).

1.3 Description of the Integrated Safety Management Plan

Each of the elements of the safety approach are described in detail in the following sections.

1.3.1 Project Initiation

The Project safety approach began with a discussion to aid in understanding of the work to be accomplished and the development of the conceptual design of the processes and facility to accomplish this work. The development of the conceptual design considered the work to be performed, hazards and hazardous situations identified for similar facilities, and the methods to eliminate or control these hazards and hazardous situations. Early in the development of the conceptual design, hazards identification and evaluation techniques appropriate for the preliminary nature of the process and facility design were selected and applied.

1.3.2 Laws/Regulations/Top-Level Safety Requirements/Best Industry Practices

Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors, DOE/RL-96-0006 (DOE-RL 1996b) provides a set of top-level radiological, nuclear, and process safety standards and principles prescribed by DOE for accomplishing the required level of safety for the RPP-WTP. This document is used as one resource for the development of the SRD. Included in DOE/RL-96-0006 are radiological exposure and risk standards for evaluation of normal and offnormal events. Additional resources for the identification of standards were derived from the U.S. and United Kingdom (UK) commercial nuclear and chemical industries. The identification of the remaining requirements is described in the following section.

1.3.3 Safety Requirements

The SRD defines the Safety Criteria and the design requirements (implementing codes and standards) necessary to protect the public and workers from radiological, nuclear, and process hazards and hazardous situations. The Safety Criteria and codes and standards of the SRD are applied to the RPP-WTP. The SRD, as well as the ISMP, applies to Project contractors. By application of the SRD and ISMP to all Project activities, a consistent project-wide approach is applied to Environmental, Safety, and Health (ES&H) matters. The hazards and hazardous situations at the facility will change significantly throughout the construction, operation, and deactivation phases of the Project. The SRD was developed by an iterative process that will continue as the design matures through the construction, commissioning, operation, and deactivation of the facility. The development involved identifying the work to be performed, identifying hazards and hazardous situations of the facility operation by the PHA and accident analyses, reviewing of pertinent regulations and industry practices, and identifying engineered and administrative controls.

Once the work activity was identified for the Project and the hazards associated with this work determined, the Safety Criteria were defined by the requirements necessary to ensure protection of the public and workers from radiological, nuclear, and process hazards. The Safety Criteria are based on the following:

1) Mandated regulatory requirements (statutory and contractual; including those identified as top-level safety requirements [standards and principles]) and equivalent requirements
2) Requirements and guidance documents deemed relevant to waste management facilities such as this Project
3) Best industry practices from the government, commercial nuclear, and chemical industries

The engineered and administrative controls necessary to eliminate and control hazards and hazardous situations are established via the PHA, the accident analysis, and the necessary level of protection required to satisfy the SRD Safety Criteria. Once the controls are selected, the SRD identifies the implementing codes and standards necessary to ensure that engineered and administrative controls are properly designed, implemented, and maintained. The requirements, guidance documents, and practices are incorporated into the SRD, tailored toward applicability to RPP-WTP operations, the control of hazards, and the adequacy to protect public and worker health and safety. These codes and standards are used by the appropriate organizations to ensure that the design, construction, testing, and maintenance of Important-to-Safety SSCs are such that they can perform their specified public and worker safety functions when required. Additional detail on the SRD and definition of Important-to-Safety is provided in ISMP Section 4.1, "Safety Management Processes" and Section 1.3.10, "Classification of Structures, Systems, and Components".

1.3.4 Process Hazards Analysis

The PHA process is a systematic team-based approach used to identify and analyze the significance of potentially hazardous situations associated with the operation and maintenance of the RPP-WTP. Other hazardous situations unique to the deactivation phase will be identified near the end of waste processing operations. The PHA process includes preliminary hazard analysis and Hazard and Operability (HAZOP) Analysis. The process is enhanced by the experience gained by the Project team from similar analyses performed at similar facilities. The PHA is performed to ensure the facility is designed to provide accident prevention and mitigation controls as required to meet safety criteria established for the protection of the public and workers. The PHA team includes members experienced in the engineering design and operation of the chemical process being evaluated and at least one member knowledgeable in the specific PHA methodology being used. The results of the PHA are also strengthened by the use of the operational and maintenance experience of the team members to compliment the design process. Specifically, the goals of PHA are to

1) Identify hazards and potential hazardous situations associated with a process or activity
2) Identify features in the design or operation of the facility that could lead to accidents
3) Assist designers in identifying the need for design features to eliminate or control hazards and hazardous situations
4) Identify principal operability concerns to assist designers in eliminating or minimizing the associated risk

The focus of the analysis is on process safety issues, such as the acute effects of unplanned radiological and chemical releases on the public or workers. The PHA supplements the more traditional industrial health and safety activities that consider, for example, protection against slips or falls, use of personal protective equipment, and monitoring for employee exposures. Additional detail on the PHA is provided in ISMP Section 5.5, "Process Hazards Analysis".

1.3.5 Facility Design/Development Activities and Safety Features Identification

The PHA and the accident analyses identify the need for accident prevention and mitigation controls to satisfy the SRD Safety Criteria. There will be differences between the prevention and mitigation techniques needed during facility operation and those needed during the deactivation process. Both sets of needs are communicated to the design groups for the selection of the most effective and efficient means of achieving the required controls. In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls. Preference is also given to passive engineered features over active engineered features (ISMP Section 3.7, "Proven Engineering Practices"). Reliance on human intervention would be used only when reliance on other means of eliminating or mitigating the hazardous situation cannot be used. The features identified are maintained or changed, as needed, as the facility moves from operation to deactivation. Control of the features is discussed in more detail in ISMP Section 3.5, "Quality Assurance Program (QAP)", Section 1.3.16, "Configuration Management", and Section 5.3, "Configuration Management".

1.3.6 Accident Analysis

During the design phase, the set of potential accidents identified by the PHA is carried forward to the accident analysis to identify the need for prevention and mitigation controls required during operation or for deactivation to satisfy the SRD Safety Criteria. The Project team experience with accident analyses for similar facilities is particularly valuable in developing the models for the accident scenarios to be analyzed. Well-established methods that include factors such as the material at risk and the rate and duration of the release of hazardous material are used in the determinations of the source terms (NRC 1988; DOE 1994).

Evaluating potential accidents involves the following tasks:

1) Separating the lower-risk accidents adequately addressed by the PHA from the higher-risk accidents that warrant quantitative analysis to confirm risk acceptance guidelines are satisfied
2) Grouping the accidents based on considerations such as the location of the accident, the phenomena involved, the accident type, and the nature of the hazardous material at risk
3) Calculating the radionuclide or chemical release from the facility and the impact of the release on the facility operators whose actions are credited to maintain the public and workers radiological and chemical exposures within defined standards

1.3.7 Acceptable Level of Public Safety

During the facility design evolution, a consequence analysis is performed for each accident involving a radionuclide or chemical release. For those accidents that involve a radionuclide release, the calculated exposures are compared to the radiological exposure standards of Table 1-2 to determine the need for accident prevention or mitigation features credited for public safety. For chemical release, the projected exposure is compared to the standards of SRD Safety Criterion 2.0-2. If the radiological or chemical release standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed. These features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention or mitigation of accidents. Features credited for satisfying the public radiological exposure standards of Table 1-2 and chemical release exposure standards of SRD Safety Criterion 2.0-2 are classified as Safety Design Class (which is a subset of Important-to-Safety as discussed in Section 1.3.10, "Classification of Structures, Systems, and Components). The location of the public (i.e., offsite receptor) for the purpose of establishing compliance with Table 1-2 and the chemical release standard, is established at the most limiting exposure location along the near exposure bank of the Columbia River, Highway 240, and a southern boundary as shown in Figure 1-2. If credit is taken for operator action to satisfy the public radiological exposure standards of Table 1-2, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation doses in excess of 5 rem TEDE whole body gamma and 30 rem beta skin for the duration of the accident. If credit is taken for operator action to satisfy public chemical exposure to the standards specified in SRD Safety Criterion 2.0-2, provisions are made so that the operator exposure does not exceed the standard specified in SRD Safety Criterion 4.3-7.

Table 1-2 Radiological Exposure Standards Above Normal Background (Sheet 1)

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Normal Events: Events that occur regularly in the course of facility operation (e.g., normal facility operations); including routine and preventative maintenance activities.	>0.1	Normal modes of operating facility systems should provide adequate protection of health and safety.	5 rem/yr 50 rem/yr any organ, skin, or extremity 15 rem/yr lens of eye 1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b) (1)	5 rem/yr 1.0 rem/yr ALARA design objective per 10 CFR 835.1002(b) (1)	10 mrem/yr (airborne pathway) 100 mrem/yr (all sources) 100 mrem/yr (public in the controlled area) 25 mrem/yr (radioactive waste)
Anticipated Events: Events of moderate frequency that may occur once or more during the life of a facility (e.g., minor incidents and upsets).	10^{-2}<f10^{-1}	The facility should be capable of returning to operation without extensive corrective action or repair.	5 rem/event (2, 3) 1.0 rem/event design action threshold (4)	5 rem/event (2, 3) 1.0 rem/event design action threshold (4)	100 mrem/event (3)

Table 1-2 Radiological Exposure Standards Above Normal Background (Sheet 2)

Description	Estimated Frequency of Occurrence f (yr^{-1})	General Guidelines	Worker	Collocated Worker	Public
Unlikely Events: Events that are not expected, but may occur during the lifetime of a facility (e.g., more severe incidents).	10^{-4}<f10^{-2}	The facility should be capable of re-turning to operation following poten-tially extensive corrective action or repair, as necessary.	25 rem/event (2, 3)	25 rem/event (2, 3)	5 rem/event (3)
Extremely Unlikely Events: Events that are not expected to occur during the life of the facility but are postulated because their consequences would include the potential for the release of significant amounts of radioactive material.	10^{-6}<f10^{-4}	Facility damage may preclude returning to operation.	25 rem/event (2, 3)	25 rem/event (2, 3)	25 rem/event 5 rem/event target (3) 300 rem/event to thyroid
Location of Receptor			Within the Controlled Area Boundary	The most limiting location at or beyond the Controlled Area Boundary	The most limiting location along the near river bank/Hwy 240/ southern boundary

(1) In addition to meeting the listed design objective of 10 CFR 835.1002(b), the inhalation of radioactive material by workers and collocated workers under normal conditions is kept ALARA through the control of airborne radioactivity as described in 10 CFR 835.1002(c).

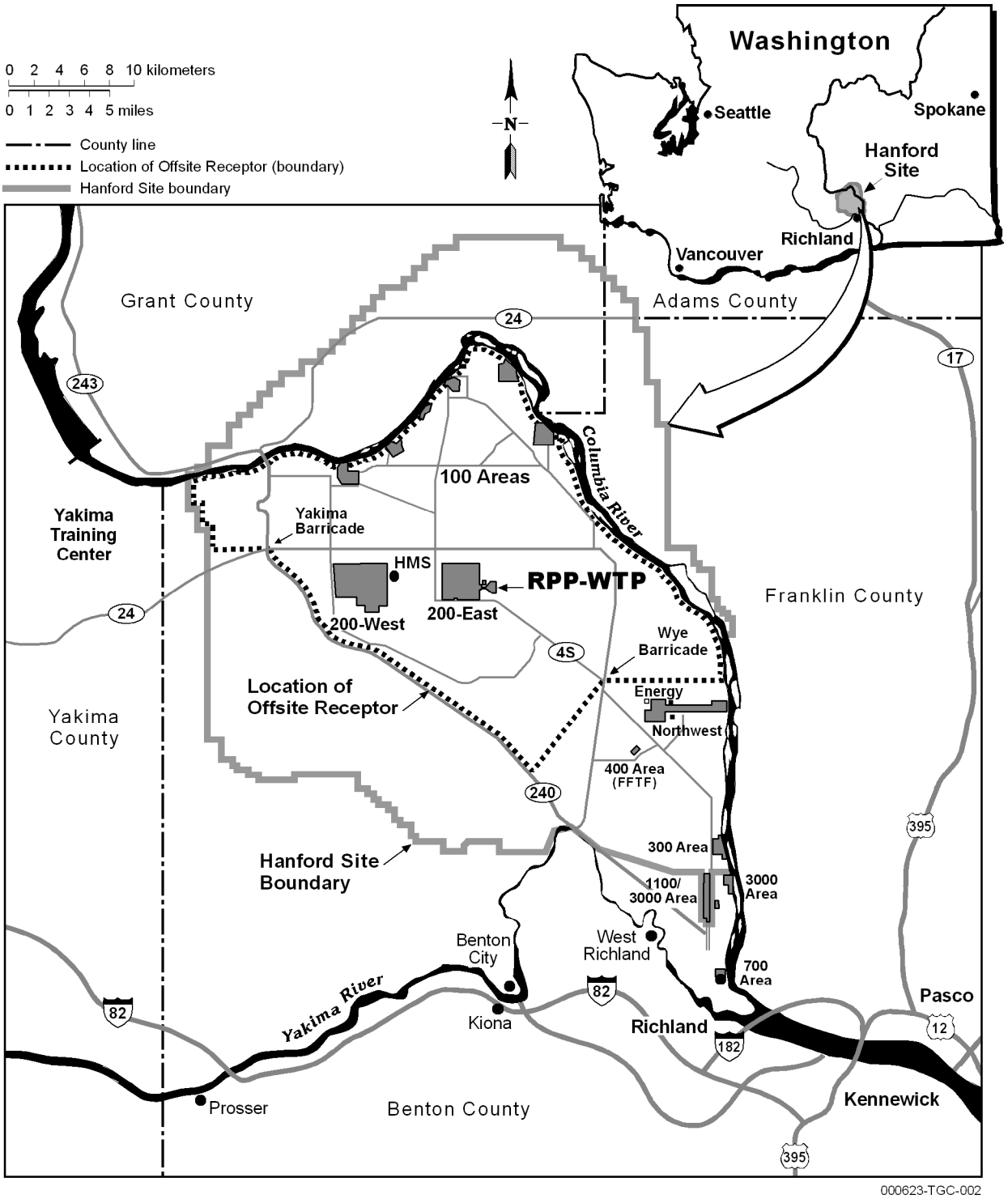
(2) In addition to meeting the listed worker and collocated worker exposure standards for accidents, the Worker Accident Risk Goal is satisfied through the calculation of the risk from accidents with accident prevention and mitigation features added as necessary to meet the goal.

(3) In addition to meeting the listed exposure standards for accidents, the Project approach to accident mitigation is to evaluate accident consequences to ensure that the calculated exposures are far enough below standards to account for uncertainties in the analysis and to provide for sufficient design margin and operational flexibility.

(4) When a calculated accident exposure exceeds this threshold, appropriate actions are taken. These include carrying out a less bounding (i.e., more realistic) evaluation to show that the accident consequences will be below the threshold or evaluating additional safeguards for cost effectiveness and/or feasibility. This threshold is not a limit; it does not require the implementation of additional preventative or mitigative features if they are not both cost effective and feasible.

A conservative approach is applied to accident consequence analysis in terms of input assumptions, boundary conditions, modeling techniques, and compliance with public radiological and chemical release standards. As the process and facility design mature, the analysis is refined to eliminate unnecessary conservatism that may have been applied solely to cover uncertainties in design. This strategy is consistent with a risk-based approach that allows the use of uncertainty analysis to better identify the impact of the assumptions and state of knowledge on results from the safety analysis.

Figure 1-2 Location of Public Receptor



1.3.8 Acceptable Level of Worker Safety

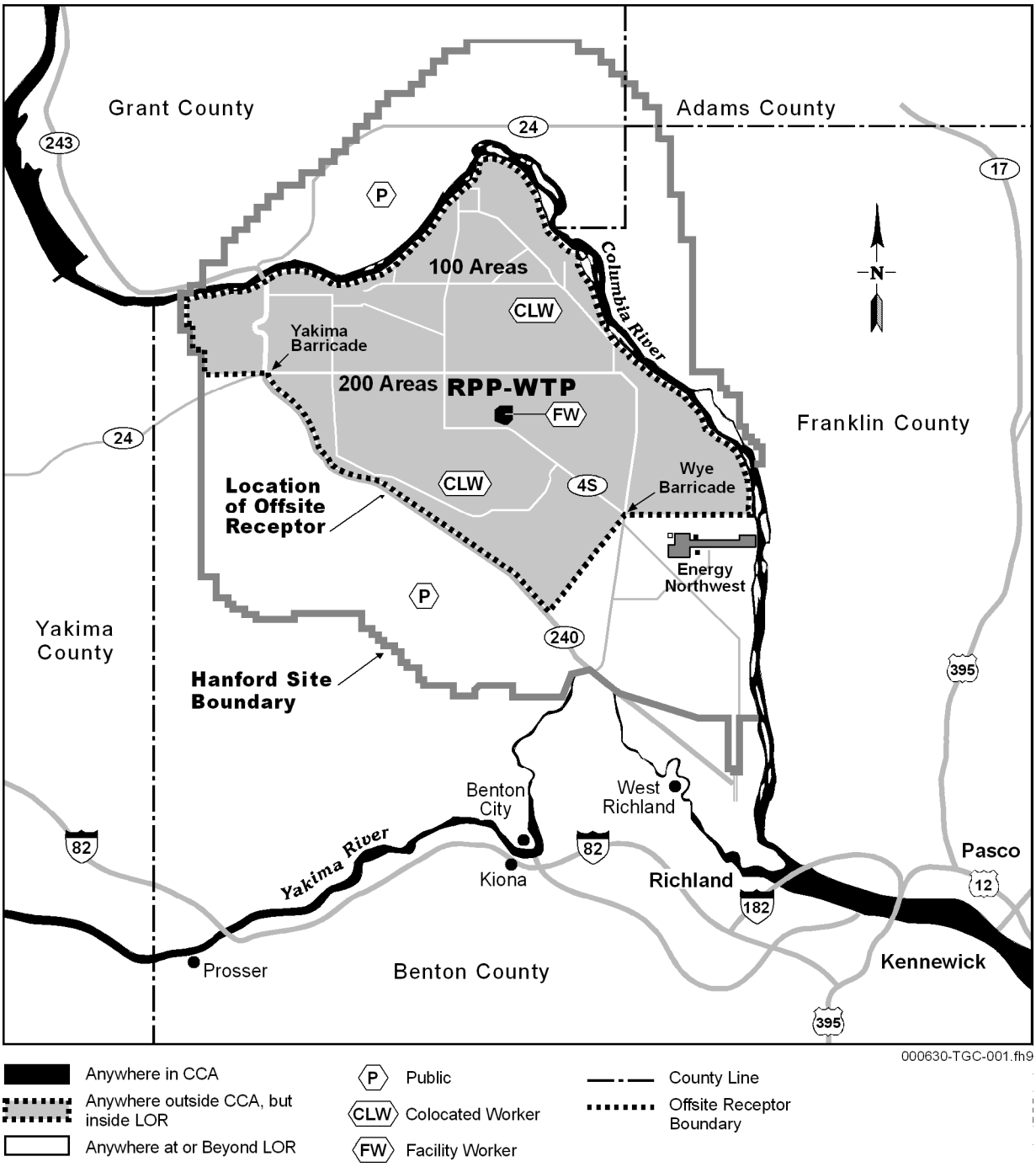
Radiological exposure standards applied to the facility worker and collocated worker are provided in Table 1-2. The location of the workers is shown in Figure 1-3. A 5 rem/event standard is applied to the workers for anticipated events, and a 25 rem/event exposure standard is applied to workers for unlikely and extremely unlikely events. The 25 rem/event standard corresponds to the once-in-a-lifetime accident or emergency exposure for radiation workers which, by recommendation of the National Committee on Radiation Protection (NCRP 1963), may be disregarded in the determination of their radiation exposure status. In addition, an exposure of 25 rem/event corresponds to a conditional probability of fatality of about 2×10^{-2}. For unlikely events (defined in Table 1-2 as having a maximum occurrence frequency of 10^{-2}/yr), this equates to a maximum increase in worker lifetime risk of premature death of about 2×10^{-4}/yr, which is less than the average of the accidental death risk for workers in some of the safest industries, such as retail and wholesale trade, manufacturing, and service (EPA 1991).

Compliance with the 25 rem/event worker standard is established using qualitative methods of the PHA supported, where necessary, by numerical analyses that may include the development of event trees and fault trees or the performance of consequence analyses. From this process, preventative and mitigative engineered and administrative controls to be added to the design are identified. The PHA identifies hazards and operability problems based on the design detail available and experience with similar facilities. Further hazard evaluation takes place in parallel with design development to ensure that safety is built into the design process. Having generated the list of hazards, this list is subject to a further systematic team-based review where a binning process takes place. The binning process is essentially the risk-based categorization of hazards and hazardous situations according to a frequency/consequence matrix.

The 25 rem/event worker standard for unlikely or extremely unlikely events applies to events with frequencies less than 10^{-2}/yr. For those frequencies, the PHA assigns serious and major hazardous situations as either undesirable, acceptable with controls, or acceptable. For a hazardous situation to be acceptable, the situation must have consequences less than 25 rem. Where there is uncertainty concerning the appropriate hazard category to be assigned, the hazard is binned to the higher category to ensure that the accident analysis remains conservative.

For those accidents that involve a radionuclide release, the calculated exposures are compared to the radiological exposure standards of Table 1-2 to determine the need for accident prevention or mitigation features credited for worker safety. For chemical release, the projected exposure is compared to the standards in ERPG-2. If the analysis of radiological or chemical exposures do not confirm the adequacy safety, the need for engineered or administrative controls to prevent or limit the release is addressed. These features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention or mitigation of accidents. Features credited for satisfying the radiological exposure standards of Table 1-2 and chemical release exposure standards of ERPG-2 (AIHA 1988) are classified as Safety Design Class.

Figure 1-3 Location of Facility and Collocated Workers



The worker accident risk goal is stated in DOE/RL-96-0006 as, "The risk, to workers in the vicinity of the Contractor's facility, of fatality from radiological exposure that might result from an accident should not be a significant contribution to the overall occupation risk of fatality to workers" (DOE-RL 1996b, Section 3.1.3). This goal is satisfied by calculating the risk of facility operation to the workers at the RPP-WTP. This is a best-estimate analysis based on realistic input and modeling assumptions. In performing this analysis, all SSCs capable of preventing or mitigating the event are considered. The evaluation of the availability and reliability of the SSCs include factors such as failures to start and failures to operate, as well as unavailability resulting from maintenance activities. Accident prevention and mitigation controls are added to the design as necessary to satisfy the worker accident risk goal.

If credit is taken for operator action to satisfy the worker radiological exposure standards of Table 1-2, adequate radiation protection is provided to permit access and occupancy of the control room or other control locations under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body gamma and 30 rem beta skin for the duration of the accident. If credit is taken for operator action to satisfy worker chemical exposure to the standard specified in SRD Safety Criterion 2.0-2, provisions are made so that the operator exposure does not exceed the standard specified in SRD Safety Criterion 4.3-7.

Additional details on the radiological exposure standards applied to the public and workers are provided in Appendix D of 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document Volume II*, which also provides information on the basis for the assumed location of the receptors.

1.3.9 Quality Assurance Program

The quality assurance program (QAP) is an important tool in achieving the goal of the safe operation of the RPP-WTP. The QAP defines the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work to be performed. The Project developed its quality assurance program (QAP) in compliance with the requirements of 10 CFR 830.120, "Quality Assurance Requirements", so the integration of the QAP for the TWRS-P Project began during the initial phases of the project. The QAP document for Part A has been submitted to and approved by the U.S. Department of Energy (DOE) (Sheridan 1997). The QAP document for Part B activities has been submitted to DOE; this version (BNFL 1998c) has been approved by the DOE Regulatory Unit (Gibbs 2000). BNI revised the BNFL/CHG QAP document into a Quality Assurance Manual (QAM). This QAM (BNI 2001) superceded the CHG QAP document (i.e., BNFL-5193-ISP-01, Revision 8) in its entirety.

As a result of early development of the QAP, the PHA, SRD, and HAR were developed in accordance with the requirements in the QAP. The application of the requirements of the QAP continues during design, procurement, construction, commissioning, inspections, operations, maintenance, modifications, and deactivation of the facility. Administrative processes such as training, procedure development, and configuration management are subject to the requirements of the QAP. The QAP is used by the Project team to ensure that all aspects of the integrated safety approach have been implemented for the Project.

The RPP-WTP Project QAP document (i.e., BNFL-5193-QAP-01, Revision 8) was restructured to reflect BNI QA program policy, as well as use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE O 414.1A (DOE 1999), as issued in a *Quality Assurance Manual* (BNI 2001). This QAM serves as the Authorization Basis document for implementation of the Project QA program. The QAP requires periodic assessments of activities, both by management and by knowledgeable, independent personnel, as described in QAM section 18. The conduct of audits to objectively evaluate the effectiveness and proper implementation of the QAM for activities affecting quality of SSCs and surveillances of specific project activities (e.g., process controls, preparation of safety documentation, configuration and document control, and records management) to supplement the compliance audit program are also described in the QAM. The QAM also describes the process of qualifying personnel who perform assessments, audits, and surveillances, as well as documentation of results and review by management.

Performance monitoring is used to verify that the necessary programs, plans, and procedures are functioning to ensure that activities are maintained in compliance with the applicable requirements. The findings of performance monitoring are used to determine if changes are needed to ensure that the high standards of performance expected are achieved.

The QAP ensures that identified corrective actions are implemented and any follow-up actions, such as the performance of a re-audit of a deficient condition, are conducted.

Different aspects of the implementation of the QAP are discussed in the following parts of the ISMP:

1) Chapter 2.0 “Compliance with Laws and Regulations”
2) Section 3.5 “Quality Assurance Program”
3) Section 5.4 “Compliance Audits”
4) Chapter 10.0 “Assessments”

1.3.10 Classification of Structures, Systems, and Components

The design classification process used on the Project provides a consistent, project-wide approach for the classification of the RPP-WTP SSCs based on their importance to controlling normal releases and accident prevention and mitigation. This approach ensures that SSCs are designed, constructed, fabricated, installed, tested, operated, and maintained to quality standards commensurate with the importance of the functions that need to be performed. As the facility moves to deactivation, and the safety functions change, the classification of SSCs will be revised as necessary.

The design classification system provides assurance to DOE that the defined safety functions of SSCs will perform as intended.

In this system, SSCs are designated as Important-to-Safety in accordance with the definition of this term as provided in *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b).

SSCs defined as Important-to-Safety for the RPP-WTP include the following.

1) SSCs needed to prevent or mitigate accidents that could exceed public or worker radiological and chemical exposure standards of Table 1-2 and SSCs needed to prevent criticality. This set of SSCs includes both the front line and support systems needed to meet these exposure standards or to prevent criticality. This set of Important-to-Safety SSCs are designated as Safety Design Class.
2) SSCs needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation; and SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction. This set of Important-to-Safety SSCs are designated as Safety Design Significant.

The processes for identifying the SSCs for each of the two groups of SSCs Important-to-Safety and the requirements assigned to each of the two groups are discussed below.

Safety Design Class SSCs typically are identified by the results of accident analyses that show the potential for exposure standards to be exceeded. However, additional items also are designated Safety Design Class independent of a specific accident analysis. These are items that protect the facility worker from potentially serious events. Typically, these events are deemed to present a challenge to the facility worker severe enough that mitigation is prudent, without the need to perform a specific consequence analysis. These latter items are identified by the results of the HAR.

Safety Design Significant SSCs are identified in several ways including: (1) SSCs identified as significant contributors to safety by the risk analyses that confirm the facility accident risk goals are met (this is one way to identify SSCs that place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction), (2) SSCs that are needed to ensure that standards for normal operation are not exceeded (e.g., bulk shield walls or radiation monitors), (3) SSCs selected based on the dictates of nuclear and chemical facility experience and prudent engineering practices, and (4) SSCs whose failure could prevent Safety Design Class SSCs from performing their safety function (e.g., Seismic II/I items).

SSCs identified in ISAR Section 4.8, “Controls for Prevention and Mitigation of Accidents” as Design Class I and II are Safety Design Class SSCs. SSCs provided to protect the health and safety of the public and collocated workers usually are considered to also provide adequate protection of the environment. As stated in ISAR Section 4.8, “The selection of engineered and administrative controls is based on the conceptual design of the facility. Additional or different features may be identified during Part B”. The more complete group of Important-to-Safety SSCs will be identified in Part B and provided in the Preliminary Safety Analysis Report (PSAR) as part of the Construction Authorization Request. The PSAR and the Final Safety Analysis Report also will describe SSCs that are not designated as Important-to-Safety. The descriptions of these SSCs will note that they are not classified as Important-to-Safety.

When a SSC is designated as Safety Design Class it has the following attributes:

1) Quality Level 1 (QL-1) is applied to the SSC. The QAP describes the requirements associated with QL-1.

2) For an active system or component, the safety function is preserved by application of defense-in-depth such that failure of the system or component will not result in exceeding a public or worker accident exposure standard. For a mitigating feature, this means that, given that the accident has occurred, the consequence of the accident will not result in exceeding a public or worker exposure standard. For a preventative feature, this means that the failure of the system or component will not allow the accident to occur and progress such that a public or worker accident exposure standard is exceeded. This requirement may be achieved by designing the Safety Design Class system or component to withstand a single active failure or by designating two separate and independent systems or components as Safety Design Class.

3) The SSC is designed to withstand the effects of natural phenomena such that it can perform any safety functions required as a result of a natural phenomena event. For example, if an earthquake can produce exposures to the public or workers in excess of standards, the Safety Design Class SSC that prevents or mitigates the exposures would be designed to be DBE-resistant and designated as Seismic Category I for radiological hazards (or Seismic Category III for chemical hazards). However, DBE-resistance is not applied automatically to Safety Design Class SSCs. It is applied only when the earthquake is the initiating event, or when the earthquake could cause the initiating event. A Safety Design Class SSC that does not have a DBE mitigating function is designated as Seismic Category III.

   This natural phenomenon hazard (NPH) design philosophy is used for all severe natural phenomena events (i.e., earthquake, flood, high wind). Therefore, if a Safety Design Class SSC is needed for meeting public or worker exposure standards for a given NPH event, the NPH loads associated with that event are taken from SRD Volume II, Table 4-1, "Natural Phenomena Design Loads for Important-to-Safety SSCs with NPH Safety Functions". All other NPH loads for the Safety Design Class SSC may be taken from SRD Volume II, Table 4-2, "Natural Phenomena Design Loads for SSCs without NPH Safety Functions" in lieu of SRD Table 4-1.

4) General design requirements are applied as identified in Section 4.0 of the SRD for Safety Design Class SSCs. See SRD Safety Criterion 4.1-5 as an example.

5) Specific design requirements based on the type of component are applied as invoked in SRD Chapter 4.0. For example, SRD Safety Criterion 4.4-5 provides requirements associated with Safety Design Class air treatment systems.

6) Other design requirements may be applied based on the specific safety function to be performed by the Safety Design Class SSC. This specific safety function is determined from the accident analysis that identified the need for prevention or mitigation by Safety Design Class SSCs.

7) Operational requirements (e.g., periodic testing and preventative maintenance) are applied to Safety Design Class SSCs through the application of Technical Safety Requirements (discussed in ISMP Section 4.2.3.4 "Technical Safety Requirements").

When a SSC is classified as Safety Design Significant it is has the following attributes.

1) Quality Level 2 (QL-2) is applied to the SSC. The QAP describes the requirements associated with QL-2.
2) The SSC is designed to withstand the effects of natural phenomena such that it can perform its safety functions required as a result of a natural phenomena event. If an earthquake can produce exposures to the public or workers in excess of standards, the Safety Design Class SSC that prevents or mitigates the exposures would be designed DBE-resistant as discussed above. The same NPH loads also are applied to a Safety Design Significant SSC if failure of the item could prevent the Safety Design Class SSC from performing its safety function required as a result of the DBE. Such an SSC is designated Seismic Category II. It should be noted, however, that DBE resistance is not automatically applied to Safety Design Significant SSCs. It is applied only when the earthquake is the initiating event, or when the earthquake could cause the initiating event. A Safety Design Significant SSC that does not have a DBE mitigating function is designated Seismic Category III.

   This NPH design philosophy is used for all severe natural phenomena events (i.e., earthquake, flood, high wind). Therefore, if a Safety Design Significant SSC is needed to meet public or worker exposure standards for a given NPH event, the NPH loads associated with that event are taken from SRD Volume II, Table 4-1, "Natural Phenomena Design Loads for Important-to-Safety SSCs with NPH Safety Functions". All other NPH loads for the Safety Design Significant SSC may be taken from SRD Volume II, Table 4-2, "Natural Phenomena Design Loads for SSCs without NPH Safety Functions" in lieu of SRD Table 4-1.
3) General and specific design requirements are applied as identified in Section 4.0 of the SRD for Safety Design Significant SSCs.
4) Other design requirements again may be applied based on the specific safety function to be performed by the Safety Design Significant SSC.

1.3.11 Quality Levels

The assignment of Quality Levels (QL) is the method by which the implementation of the graded quality approach discussed in 10 CFR 830.120, "Quality Assurance Requirements" is ensured. Designation of correct quality levels helps to ensure that the appropriate quality assurance requirements are applied to specific RPP-WTP SSCs. The quality levels of the Project quality assurance approach and their applications are described in the QAP.

1.3.12 Training

Training serves an important role in the Project by ensuring that the personnel involved with the project have sufficient knowledge to safely fulfill the roles and responsibilities of their assigned tasks. Training has a direct impact on safety during design, construction, operation, and deactivation of the project by:

1) Improving technical ability
2) Enhancing personal skills
3) Increasing awareness of signs of potential hazardous situations in the workplace

4) Increasing personal awareness of the potential impact of actions taken with regard to the safety of the individual, others, and the facility
5) Establishing a safety culture that clearly assigns the responsibility for safety to the individual

During the design and construction phases of the project, the training focus is on the requirements such as design evolution, compliance with regulations and commitments, construction activities, and quality assurance.

Operator training and qualification is of specific importance in the training program. The operator training program is enhanced by the experience of the Project team at other similar facilities and by the information made available during the design phase and the commissioning program. In addition, operation of the demonstration plants provides invaluable training opportunities for the facility operators.

In recognition that different training is required for different assignments, the training plan addresses the assessment of training requirements and responsibilities and the evolution of the training plan required as the project matures. Additional information on training is provided in ISMP Section 3.15 "Training and Qualification" and Section 4.2.2, "Training and Procedures". The training plan is described in ISAR Section 3.4, "Training and Qualification".

1.3.13 Procedures

Procedures are one tool by which compliance with requirements is ensured during the design, construction, operation, and deactivation of the project. All activities that may affect safety of the public and workers are performed in accordance with step-by-step instruction provided in procedures. The range of activities covered in procedures includes, but is not limited to:

1) Design control
2) Procurement activities
3) Monitoring contractors
4) Identification and resolution of nonconforming conditions
5) Operations and maintenance
6) Emergency plan implementing procedures

There is a defined hierarchy of procedures commensurate with the philosophy used to developed the tailored levels of design classification and quality levels. For example, procedures supporting the implementation of Technical Safety Requirements that are credited for accident prevention or mitigation will have a greater safety significance than procedures supporting maintenance activities on other SSCs. Those procedures, at the highest level, are subject to increased rigor with respect to their development, review, implementation, and change. Increased rigor includes requirements for independent review and approval by qualified and experienced personnel or safety committees. Training emphasizes the importance of the hierarchy as well as the content of the procedures and the requirement to follow procedures to ensure safe and efficient activities.

One category of procedures is the operating procedures. These procedures are developed during the design and construction phase, when more detailed design information is available. The design information, test data, and design requirements are incorporated into the operating procedures. The operating procedures address normal and off-normal facility conditions, process startup and shutdown, and emergency events. The development and control of the operating procedures are summarized in ISMP Section 5.6.1, "Procedure Development", and is addressed in ISAR Section 3.9, "Procedures".

1.3.14 Commissioning

Another integral portion of the safety approach is the commitment to a thorough startup testing program. The program validates that the design, construction, hardware, programs, and personnel are ready to support the safe operation of the facility. The tests performed ensure that the equipment and facility are properly built and will operate as designed prior to transition to the operational phase. In addition, the startup testing program documents the as-built configuration and the initial operating parameters of the facility. The program serves as an opportunity to perform a final system analysis and to detect significant faults prior to facility operation. The startup testing program is also used to confirm the adequacy of training and procedures to be used for facility operation.

The method of testing used in the startup testing program can require analysis, demonstration, examination, inspection, or functional test. The selection of the appropriate test method and scope of the tests are determined using a systematic analysis and are described in ISAR Chapter 3.0, "Conduct of Operations". In general, the startup testing program is a phased program, with successful individual component testing leading to system functional and interface testing, followed by the integrated system testing. A final phase of the program, testing with design waste feed materials, must be successful completed before the facility transitions to an operational phase. Additional information is provided in ISMP Section 3.14, "Startup Testing and Operation" and Section 5.6.4, "Startup Review".

1.3.15 Operations

The Project safety approach, which began with the design phase and is followed through the construction and testing phases, is also emphasized in the operational phase by establishing a set of principles for achieving excellence in operation of the RPP-WTP. This set of principles is implemented as a Conduct of Operations program (see ISAR Section 3.11, "Operational Practices") that controls and conducts the operations of the facility. Attributes of the program include the following.

1) Operation of the facility in accordance with the Technical Safety Requirements
2) The establishment of high standards
3) The communication of those standards to the workforce
4) Provisions for the sufficient number of qualified personnel required to perform the activities necessary to meet the standards
5) Implementation of a philosophy to hold workers and managers accountable for their performance

The conduct of operations program practices are major contributors to the safety of the public and workers. The practices are summarized in the ISAR Chapter 3.0, "Conduct of Operations", and detailed guidance on the practices will be incorporated in the RPP-WTP procedures. The conduct of operations program includes shift routines and operational practices (e.g., operator inspection tours, log keeping, response to indications, and resetting protective devices), control area activities (e.g., communications and on-shift training), control of equipment status, lockouts and tagouts, independent verification, operations turnover, required reading, operations procedures, operator aid postings, equipment and piping labels, and incident investigation and reporting.

Another key element in the safety approach is the involvement of operations personnel throughout the design process and the involvement of the design personnel through turnover of the facility to the operations staff (see ISAR Section 3.10.1, "Testing Program Description"). This involvement allows operations personnel not only to provide input to the design process to develop a safe and operable facility, but also to become knowledgeable in the features and limitations of systems and components of the facility. Additionally, the development of facility control system simulators in advance of facility testing strengthens the ability and confidence in the performance of the systems and the operational interfaces. The simulators provide an important integration of the design and operating personnel during the testing in further support of a smooth transition to the operational phase of the project. This interface between the designers, the operators, and the simulators ensures the ability of the Project team to demonstrate operational readiness in advance of final testing activities of the facility.

1.3.16 Configuration Management

Configuration management is one of the fundamental principles to achieve safety. Throughout the life cycle of the RPP-WTP, configuration management is applied to all activities to ensure that programmatic objectives related to radiological, nuclear, and process safety are achieved. Work is performed and controlled to pre-approved plans and procedures that delineate responsibilities. Records that define the requirements, design, verification, and acceptance of the RPP-WTP are retained to provide an accurate record of the design including approved changes to the design. Operating organizations define operational requirements and participate in design review, procedure preparation, training, and planning activities to become familiar with the features and limitations of components included in the design of the facility. Organizations that manage or interface with subcontractors or suppliers of items, activities, or services involving configured items flow down applicable requirements to ensure that the configuration management process as defined in the *RPP-WTP Configuration Management Plan* (CM Plan) (BNI 2001f) are properly implemented.

The WTP Configuration Management Program provides direction to identify and document the physical and functional characteristics of facility structure, systems, components, and computer software applications. Its application to design, construction, commissioning, operations, and deactivation activities ensures proposed changes to these characteristics are properly developed, approved, implemented, verified, and incorporated into facility design documentation. The CM Plan is based upon ISO 10007:1995(E), *Quality Management - Guidelines for Configuration Management.*

The project formally identifies and establishes configuration baselines, systematically evaluates and dispositions changes, and records the implementation of approved changes. The Configuration Management Program establishes the policies, guidelines, and responsibilities serving to ensure that:

- The engineered configuration of the project is controlled to ensure it meets design, performance, and acceptance requirements.
- Approved configuration changes are assessed for their impact on performance and safety.
- The configuration status of the technical baseline is maintained.

Configuration management is implemented through project plans and procedures that incorporate requirements from the CM Plan and other top-level requirements documents. Records including Authorization Basis documents; engineering and other source requirements documents; design documents; identification of structures, systems, and components; and links between the design documents and the requirements documents are maintained in an electronic data management system managed by Project Document Control.

Effective implementation of configuration management and supporting processes is assessed through management self-assessments in accordance with approved project procedures. Additionally, formal audits performed by Quality Assurance to their normal auditing practices verify compliance with approved project procedures.

1.3.16.1 Configuration Management Approach

The RPP-WTP configuration management program implements a process consisting of four basic steps, as follows:

1) **Identification and documentation.** The activities comprising selection of configured items, documenting their physical and functional characteristics, and allocating unique identification characters and numbers to the configured items and their configuration documents.
2) **Change control.** The activities comprising the control of changes to a configured item after formal issue of its configuration documents.
3) **Status tracking and reporting.** Formal recording and reporting of configuration documents, and the approved changes to those documents.
4) **Configuration audit.** Examination of review, inspection, and test records to determine that a configured item conforms to its configuration documents.

Project plans and procedures fully implement the configuration management process by delineating responsibilities for organizations that manage activities and provide services related to configuration management. Implementing procedures are cited in the CM Plan (BNI 2001f).

1.3.16.2 Configured Item Identification and Documentation

Configured items are selected and documented taking into consideration at what level functional and physical characteristics can be best managed to achieve the overall WTP Project performance objectives related to radiological, nuclear, and process safety. Items identified for configuration management include structures, systems, and components; plant installed software; project interfaces; and Authorization Basis documents.

1.3.16.3 Change Control

Design configuration is controlled in accordance with approved project procedures to maintain an accurate record of the design. Changes are documented to describe the change, the reason for the change, and to identify the configured item and related documents to be changed.

Change control is a formal process comprised of change documentation, evaluation, approval, and implementation.

1.3.16.3.1 Documentation

Changes must be documented except for insignificant changes, i.e., those with no affect on safety, environmental protection, the Authorization Basis, scope, schedule, or cost. When the change control process uses separate change documents, the change documents shall have unique identification numbers for status tracking and convenient to establish links to affected or related documents in the electronic data management system.

1.3.16.3.2 Evaluation

Engineering evaluates proposed changes to identify interface or discipline subject matter impacts and to establish that a proposed change should be implemented. Factors to be considered in the evaluation include compliance of the change with regulations, the Authorization Basis, applicable codes and standards, and safety and environmental significance. Environmental, Safety, and Health monitors the impact evaluation process.

1.3.16.3.3 Approval

The approval process for changes is commensurate, in detail and approval authorities, with the approval process for the original configuration. This may include obtaining authorization from the PSC, customer, or regulators prior to implementing the change.

1.3.16.3.4 Implementation

Approved changes are implemented in accordance with WTP Project procedures identified in the CM Plan specific to the various configured item types encountered in design, procurement, construction, commissioning, operations, and deactivation activities.

1.3.16.4 Status Tracking and Reporting

Status tracking and reporting consists of recording and reporting information required to manage and administer the configuration management process and related activities. Information is recorded, links to related documents entered, and sorted for reporting in the electronic data management system managed by Project Document Control.

1.3.16.5 Configuration Audits

Configuration audit is the examination of items and documents to determine whether a configured items conforms to its configuration documents. Configuration audit typically consists of functional and physical confirmation.

Functional confirmation is accomplished by identifying the individual functional and performance requirements of a configured item and confirming through review, inspection, and test records that the requirements are achieved.

Physical confirmation is accomplished by examining the physical or as-built and tested configured item for compliance to its configuration documents. Together, the functional confirmation and the physical confirmation demonstrate that the configured item, as defined by its configuration documents, conforms to the physical and functional requirements.

1.3.16.6 Functions and Requirements Management

The Contract, *Basis of Design*, *Functional Specification*, *Operational Requirements Document*, and Authorization Basis design requirements are compiled in an Access © database, designated the Design Criteria Database (DCD). The database has full text and keyword search capabilities. This database is used by design and safety personnel to identify applicable safety functions and requirements for use in the WTP design. The database is updated by procedure each time a source document is revised.

The configuration management organization maintains the *Basis of Design* and DCD to integrate design requirements, safety standards, and operational requirements.

1.3.16.7 Training

The configuration management organization develops, maintains, and provides training on the configuration management program for the project. This training includes a description of the program, reasons why the program is used, the elements of configuration management, and how the program is implemented on the project. This training is provided to employees as part of the Safety and Quality Design Required Training.

1.3.17 Incident Investigations

The importance of the identification and correction of nonconforming conditions as part of a safety approach for the Project is recognized. To ensure that significant incidents that could adversely affect the quality, security, environment, operations, or health and safety of public and workers are brought to the attention of management, the project regulator, and the DOE Occurrence Reporting and Processing System, the ISMP requires incident investigation and reporting. The incident investigations for the Project are expanded in scope to include accidental radionuclide releases and the construction and startup testing phases of the project. Also, reporting of events of less severity than those required of process safety management are included in the program. Incidents to be reported to the regulator include, for example, events or conditions at the facility that resulted in degradation of the principal safety barriers or in a condition beyond the design basis or emergency procedures. The incident investigation process requires that serious events or conditions are addressed and resolved and that the findings of the investigation are resolved.

The investigations are conducted in accordance with the Safety Criteria in SRD Volume II, Section 7.7, “Reporting and Incident Investigation”. Additional detail on the implementing procedures are contained in ISAR Section 3.7, “Incident Investigations”.

1.3.18 Emergency Planning

An important aspect of the safety approach is to ensure the health and safety of the public and the workers during emergency situations at the RPP-WTP. This is accomplished through the development of an emergency management plan for the prompt, efficient, and effective response to emergencies in accordance with the applicable local, state, and federal regulations. The development and the implementation of the emergency management plan are enhanced by the involvement of BNI with the existing Hanford emergency management community. The emergency management plan is fully implemented before radioactive wastes or hazardous chemicals are introduced into the facility. The construction manager implements state and federal emergency preparedness requirements for hazardous situations that may arise during construction.

The scope of the emergency management plan will be determined following the final assessment of the hazards and hazardous situations to be completed during Part B. The implementing procedures will ensure compliance with the applicable requirements that are identified during the development of the emergency management plan. Additional information is included in ISMP Section 3.10, "Emergency Preparedness" and is presented in ISAR Chapter 9.0, "Emergency Management.

1.3.19 Deactivation

All of the previously discussed elements of the RPP-WTP safety approach are applied to the deactivation phase of the project.

In addition, the RPP-WTP incorporates design provisions to facilitate deactivation and final decommissioning. These provisions reduce radiation exposure to Hanford Site personnel and the public during and following deactivation and decommissioning activities and minimize the quantity of radioactive waste generated during deactivation.

A deactivation plan is prepared prior to construction of the RPP-WTP. The deactivation plan provides details on how the following activities will be accomplished to achieve a deactivated status for the facility.

1) Verification of the completion of the facility deactivation end point. (The term facility deactivation end point refers to the set of conditions that comprise the completion of facility deactivation [i.e., radiological, structural, equipment, and documentation])
2) Documentation of the regulatory status, conditions, and inventories of remaining radioactive and hazardous materials and health and safety requirements
3) Modification of the facilities, structures, support systems, and surveillance systems to provide for confinement and monitoring of the remaining contamination, radiation, and other potential hazards
4) Posting and securing of the facility
5) Removal of packaged special nuclear materials and other packaged radiological and chemical materials
6) Confirmation that security systems and procedures are adequate and in place to prevent unauthorized entry

2.0 Compliance with Laws and Regulations

General compliance with statutes that relate to radiological, nuclear, and process safety is described in this chapter. Compliance with 10 CFR 830.120 and 10 CFR 835 is discussed respectively in Section 2.2, "Compliance with 10 CFR 830.120, 'Quality Assurance Requirements' " and Section 2.3, "Compliance with 10 CFR 835, 'Occupational Radiation Protection'".

2.1 Statutory Compliance

New laws, regulations, and guidance documents are identified and reviewed for applicability to the design, construction, operation, and deactivation of the River Protection Project – Waste Treatment Plant (RPP-WTP). This review is coordinated by the Environmental, Safety, and Health (ES&H) Department and performed by the professional staffs of the ES&H, Quality Assurance (QA), Engineering, and Operations organizations (see Chapter 11). Changes to laws, regulations, and guidance documents are identified by review or survey of a number of sources, such as the following:

1) *Code of Federal Regulations*
2) *Federal Register*
3) *State of Washington Administrative Code*
4) *The Bureau of National Affairs Inc. Environmental Reporter*
5) Working contacts with the U.S. Environmental Protection Agency (EPA), the State of Washington, and other regulatory agencies
6) Trade journals
7) Corporate memberships on regulatory committees
8) Web sites of various agencies (e.g., US DOE, EPA, NRC, OSHA, and DOH) and organizations

For regulations that require the submittal of an implementation plan, the plan is submitted to the regulatory authority for acceptance on the schedule defined in the regulation. Exemption requests may be considered for specific elements of a regulation. However, until the granting of such a request, all elements of the regulation are considered applicable. Exemption requests are considered for the following reasons.

1) The requirement conflicts with the requirements of other regulations.
2) Meeting the requirement is not necessary to achieve its purpose.
3) A special situation exists that is not encountered by most other projects for which the regulation applies.
4) There is a net benefit to health and safety by not following the requirement.
5) There is other public interest in the granting of an exemption.
6) Temporary relief is appropriate while a program to meet requirements is being implemented. (This item would not be considered prior to operation of the RPP-WTP.)

Actions necessary to achieve compliance with laws and regulations are included in the configuration management program, which includes the identification of the need to document changes to the authorization basis. Changes to the authorization basis are managed in accordance with ISMP Section 3.3.3, which describes the process for evaluating changes to the facility design and administrative controls for potential impact on the authorization basis (AB), including performance of safety evaluations to determine whether prior DOE approval is required (for changes other than those to the approved QAP and RPP) and requests to amend the AB, if DOE approval is required. After issuance of the Production Operations Authorization, potential unreviewed safety questions (USQs) will be evaluated in accordance with the USQ process described in ISMP Section 3.16.4. The Preliminary Safety Analysis Report (PSAR) will provide a draft USQ plan.

A change being made to the RPP-WTP technical baseline configuration relating to areas of the site; structures, systems and components (SSCs); staffing; procedures; training; and computer software are performed, reviewed, and documented in accordance with procedures to ensure that a high level of protection is maintained for the public, workers, and environment. Additional information on the Project configuration management program is provided in Integrated Safety Management Plan (ISMP) Section 1.3.16, “Configuration Management”, and Section 5.3, “Configuration Management”. Details on the Project configuration management program are provided in ISAR Section 3.1, “Configuration Management”.

2.2 Compliance with 10 CFR 830.120, “Quality Assurance Requirements”

The Project quality assurance program (QAP) is implemented to ensure that the design, procurement, construction, testing, inspection, operation, maintenance, and deactivation activities conform to regulatory and contractual requirements. The QAP for Part A was submitted to and approved by the U.S. Department of Energy (DOE) (BNFL 1997a, Sheridan 1997). The QAP for Part B activities has been submitted to DOE (BNFL 1998c) and was revised several times. This version (BNFL 1998c) was approved by the DOE Regulatory Unit (Gibbs 2000) in January 2000. The RPP-WTP Project QAP document was restructured to reflect BNI QA program policy, as well as use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE Order 414.1A (DOE 1999). The restructured QA document was issued as the RPP-WTP Project *Quality Assurance Manual* (QAM) (BNI 2001). This QAM serves as the Authorization Basis document for implementation of the Project QA program.

The QAP for the Project meets the requirements of 10 CFR 830.120, “Quality Assurance Requirements”, as presented in 24590-WTP-QAM-QA-01-001, *Quality Assurance Manual* (BNI 2001). The implementation plan required by the 10 CFR 830.120 rule detailing implementation of the QA program as well as reflecting use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE Order 414.1A (DOE 1999) is provided as a stand-alone Quality Assurance Provisions Document (BNI 2001a). This document is not considered part of the RPP-WTP Authorization Basis, but is a supporting document.

Adherence to the Project QAP ensures the following:

1) Missions and objectives are effectively accomplished.
2) Products and services provide their required safety functions and meet or exceed the requirements and expectations of the Project regulator. Products and services that do not meet requirements are identified, controlled, and corrected (including identification of the cause and corrective action).
3) Hazards to workers, the public, and the environment are minimized.
4) Prospective suppliers are evaluated and selected on the basis of specified criteria.

The process by which the QAP is integrated into Project activities is discussed in ISMP Section 1.3.9, "Quality Assurance Program", and Section 3.5, "Quality Assurance Program". Updating the QAP is addressed in ISMP Section 3.3.3, "Changes to the Authorization Basis". Safety Requirements Document (SRD) Volume II, Section 7.3, "Quality Assurance Program (QAP)", provides criteria for the QAP.

2.3 Compliance with 10 CFR 835, "Occupational Radiation Protection"

Implementation of 10 CFR 835 and the radiation protection program is described in this section.

2.3.1 Implementation of 10 CFR 835

BNI will be in full compliance with the applicable sections of 10 CFR 835 as discussed in the RPP. A radiological controls program that implements the requirements of 10 CFR 835 and additional requirements specified in SRD Volume II Chapter 5.0 "Radiation Protection" is established. The program includes the following components:

1) Implementation of the as low as reasonably achievable (ALARA) design goal
2) Development of the Radiation Protection Program (RPP) and implementing procedures
3) Training of personnel to the RPP and procedures
4) Selection of qualified personnel to ensure safe work performance in radiological environments
5) Maintenance of records
6) Performance of reviews and audits
7) Implementation of a lessons-learned program
8) Respiratory protection
9) Sealed sources
10) Solid radioactive waste storage, packaging, and handling

Updating of the RPP is addressed in ISMP Section 3.3.3, "Changes to the Authorization Basis".

2.3.2 Potential Exemption Request (this section has been deleted)

2.3.3 Radiation Protection Program

Title 10 CFR 835.101, "Radiation Protection Programs", requires submittal of an RPP that includes the following components:

1) Content that is commensurate with the nature of the activities performed and that includes formal plans and measures for applying the ALARA process to occupational radiation exposure
2) Specification of existing or anticipated operational tasks intended to be within the scope of the RPP
3) A program that addresses, but is not necessarily limited to, each requirement of 10 CFR 835
4) A program that includes plans, schedules, and other measures for achieving compliance with the requirements of 10 CFR 835

The RPP is managed and controlled through the establishment of procedures developed according to the requirements of the QAP.

The sequence of activities for submittal of the RPP is provided in ISMP Chapter 9.0, "Scheduling of Safety-Related Activities". Part 835 does not provide a specific schedule for submittal of the RPP for a new facility. However, Section 835.101(j) implies that DOE must be given at least 180 days for review and approval of the RPP. The sequence of activities included in ISMP Chapter 9.0 allows for a DOE review of 180 days. DOE approval of the RPP specific to Part B design activities will be requested before these activities are initiated.

The formalization and implementation of the design-related components of the ALARA program are critical to all stages of design per 10 CFR 835.1002, "Facility Design and Modifications".

2.4 Environmental Radiation Protection Program

The Environmental Radiation Protection Program (ERPP) documents the program standards, requirements, administrative controls, responsibilities, and authorities for protecting the public health and safety and environment from radiological hazards associated with the RPP-WTP during normal operations. The ERPP addresses the following elements and additional requirements of SRD Volume II, Section 5.3, "Environmental Radiation Protection", and Section 5.3.1, "Environmental Radiological Monitoring", as appropriate:

1) Activities and areas of the site subject to the ERPP
2) Measures to be used to implement the ERPP
3) Methods to be used to monitor, report, and record compliance with the ERPP
4) Models and methods used for dose assessment including bioaccumulation and dose-conversion factors
5) As Low As Reasonably Achievable (ALARA) Program
6) Effluent and environmental monitoring
7) Groundwater protection
8) Radiological protection in the management of radioactive waste

9) Controls on the release of materials

10) Property containing residual radioactive materials

The outline for the ERPP is included in the ISAR as Appendix 5B "Environmental Radiation Protection Program Outline".

2.5 Compliance with 10 CFR 820, 'Procedural Rules for DOE Nuclear Facilities'

The Price-Anderson Amendments Act (PAAA) provides indemnification to DOE contractors, subcontractors, and suppliers who manage or conduct nuclear activities in the DOE complex. DOE issued 10 CFR 820, "Procedural Rules for DOE Activities", to implement the PAAA and an enforcement policy (Appendix A to Part 820) that sets forth the DOE strategy for ensuring contractor compliance. These documents subject DOE contractors, subcontractors, and suppliers to potential civil and criminal penalties for violations of DOE rules, regulations, and compliance orders that contain nuclear safety requirements. Proactive compliance by the contractor with the enforcement policy could result in the reduction, or possible elimination of, civil penalties for a noncompliance with a nuclear safety requirement. Rules that have been issued by DOE to implement the provisions of 10 CFR 820 include 10 CFR 830.120, "Quality Assurance Requirements", and 10 CFR 835, "Occupation Radiation Protection". A number of rules have been drafted but are not yet issued for implementation. Following issuance of a specific rule under 10 CFR 820, BNI will develop implementation plans as required by that rule. BNI will comply with the requirements of 10 CFR 820. To facilitate compliance to 10 CFR 820, including nuclear safety requirements contained within the regulation, training and procedures will be developed in Part B for the following activities:

1) Identifying, reporting, correcting, and tracking non-compliances

2) Preparation, review, and approval of implementation plans for nuclear safety requirements

3) Requesting and receiving exemptions to nuclear safety rules

4) Roles and responsibilities of the BNI and DOE staff implementing 10 CFR 820

5) Procedural rules for nuclear activities

Several ancillary procedures and systems also will be developed to implement 10 CFR 820, such as a procedure for performing audits and assessments, a procedure for performing root cause analysis, a system for trending non-compliances, and a commitment database for tracking corrective actions for identified deficiencies.

3.0 Conformance to Top-Level Safety Standards and Principles

This chapter discusses the methods used to conform to top-level safety standards and principles. The top-level standards and principles include any of the safety standards or principles established in DOE/RL-96-0006, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b). Among the many topics covered in the following sections are defense-in-depth, quality assurance, safety culture, training and qualification of personnel, emergency preparedness and internal safety oversight. Integrated Safety Management Plan (ISMP) Section 4.1.1, "Development of the Safety Requirements Document", provides additional information on how the top-level safety standards have been addressed for the Project.

3.1 Defense-In-Depth

3.1.1 Approach to Defense-in-Depth

The BNI approach to the control of hazardous situations is by prevention and mitigation. Prevention of hazardous situations takes place either by removing the hazard or hazardous situation by design (for example, by substituting a non-hazardous chemical for a hazardous chemical) or by providing administrative and engineered controls such that the frequency of the hazardous situation is acceptably low. Mitigation of hazardous situations is accomplished by providing reliable and robust protection such that, if the hazardous situation were to occur, its consequences would be acceptably low. This reliability and robustness is achieved, in part, by the preference for passive engineered features with their inherent safety. Administrative controls for accident prevention include training and procedures related to normal operation and facility maintenance and the commitment to a strong safety culture (Section 3.4 "Safety/Quality Culture"). Engineered features that enhance accident prevention and mitigation include application of proven engineering practices (Section 3.7, "Proven Engineering Practices").

BNI uses a deterministic approach to control hazardous situations. This is accomplished in tandem with the evolving design. Early recognition of hazardous situations when the design is most flexible allows maximum use of this approach. Where hazardous situations cannot be removed by design, protection is identified to prevent or mitigate the hazardous situation. The degree of protection applied is commensurate with the consequence and frequency of the hazardous situation. Defense-in-depth means that multiple layers of protection are applied against the hazardous situation such that no one layer of protection is completely relied on to ensure safe operation of the facility. The number of layers of protection, or barriers, is dependent upon the severity (i.e., consequence) of the hazardous situation to be prevented or mitigated. The analysis to show compliance to the accident risk goals (SRD Safety Criteria 1.0-3 and 1.0-5) may identify the need not only for additional barriers to satisfy the accident risk goals, but also to achieve additional defense-in-depth. One aspect of defense in depth is that no single failure of protection will allow a hazardous situation to occur. Protection is either passive or active; passive protection features are inherent features of the design that provides protection without the need for any action (e.g., shielding).

An element of the line of defense against the occurrence of hazardous situations is training and procedures that serve to reduce the probability of operator error and facilitate prompt and proper operator response to offnormal conditions. This prompt and reliable operator response serves to reduce the challenges to preventative and mitigative engineered safety features.

While operator response is an element of defense-in-depth in achieving effective mitigation of accident conditions, in the evaluation of the consequence of accidents to the chemical and radiological exposure standards, credit is normally taken only for engineered features.

When offnormal situations occur, the protection against release of radiological and chemical materials is ensured through multiple confinement barriers. Primary confinement is the process vessels, piping, and the dedicated process vessel ventilation system (with filtration). Secondary confinement is the cell or glovebox and its ventilation system. Tertiary confinement is provided by the operating corridor outside the cell together with another dedicated ventilation system. Design features that reduce exposure are conservatively assessed to ensure adequate protection against hazardous situations.

Design features that offer defense against the potential for exposure include shielded maintenance areas (bulges), ventilation systems providing filtered release, and area radiation and airborne monitoring systems that warn personnel of changing or unsafe conditions.

The application of the requirements of the quality assurance program during design, procurement, construction, commissioning, inspections, operations, maintenance, and modifications provides assurance that the engineered and administrative controls perform as required. Surveillances of specific project activities are conducted to determine compliance of in-process activities to quality assurance program requirements. Performance monitoring is used to verify that the necessary programs, plans, and procedures are established and implemented to ensure that activities are maintained in compliance with the applicable requirements.

Emergency preparedness is the final element of the Project approach to defense-in-depth. Emergency preparedness provides assurance that, should a significant radiological and chemical release occur, prompt action can be achieved to limit the exposure to the public and workers. Emergency preparedness includes emergency plan implementing procedures as administrative controls and instrumentation to detect and monitor the progression of accidents as engineered features.

Defense-in-depth is applied by specifying that protection against a hazardous situation is always a combination of engineered features and administrative controls providing prevention and mitigation. This means that excessive reliance is not placed on any one system to provide the majority of protection. Each protection system (i.e., mitigative or preventative, engineered, and administrative) provides the required degree of protection on its own. The design process bins hazardous situations according to their assessed consequences and frequency, which results in obtaining a hierarchy of hazardous situations according to their severity. The more severe the hazardous situation, the greater the level of protection specified. For hazardous situations identified as having the potential to exceed the public or worker exposure standards, certain engineered features are designated as Safety Design Class (see ISMP Section 1.3.10, “Classification of Structures, Systems, and Components”). These engineered features are subject to additional design, quality assurance, operational, and maintenance requirements adding confidence in their ability to perform their specified safety function.

An example of the application of defense-in-depth is the protection provided against entry into a melter maintenance room when the melter cell shield door is open. The first line of defense against such entry is training and procedures. The training informs personnel of the high radiation field present when the melter cell shield door is open and the procedures to be followed for entry into the melter maintenance room. Procedures are used to control entry into a melter maintenance room including the use of a personnel access door key lock. Engineered features that protect against inappropriate entry include a door interlock that inhibits entry when a high radiation field exists in the maintenance room.

Facility design germane to defense-in-depth typically includes SSCs that function as the following:

1) Barriers to contain uncontrolled hazardous material or energy release
2) Preventative systems to prevent hazardous situations and to protect barriers
3) Systems to mitigate uncontrolled hazardous material or energy release given barrier failure
4) Interlocks and controls to prevent hazardous situations
5) Indication and alarms that warn of the occurrence of hazardous situations
6) Interlocks and controls to prevent access to high radiation sources

Administrative controls are linked to the overall safety management programs that directly control operation. Administrative features include the following aspect of operator interfaces:

1) Procedural restriction or limits imposed
2) Manual monitoring or critical parameters
3) Equipment support functions

In addition, risk analyses are performed to confirm that facility accident risk goals of *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006 (DOE-RL 1996b) are met. These risk analyses may show that certain events are significant contributors to the overall accident risk. Additional defense-in-depth items will be specified to reduce that risk. Conversely, if the risk assessment identifies areas of excessive conservation, unnecessary controls may be removed.

In summary, defense-in-depth is applied in the following manner:

1) Conservative identification of the hazardous situation
2) Conservatism is applied in assessing design features for normal operations such that they also provide protection against hazardous situations
3) If the hazardous situation cannot be eliminated from the design the potential consequence of the hazardous situation is conservatively assessed. This can be qualitative assessment (use of a binning matrix and judgement) or a quantitative frequency and consequence calculations if deemed appropriate

4) Use of operator training and procedures as an element of defense-in-depth (i.e., the operator responds appropriately to the development of a hazardous situation to return the facility to normal operation or to place the facility in a safe state)
5) The combination of engineered features and administrative controls provided depend on the overall severity class of the hazardous situation
6) If the potential for exceeding the public or worker radiological or chemical exposures standards exists, Safety Design Class engineered features are specified
7) Application of the quality assurance program to design, procurement, construction, and operation to provide additional assurance that administrative and engineered controls are effective
8) Emergency preparedness to provide assurance that, should a significant radiological and chemical release occur, prompt action can be achieved to limit the exposure to the public and workers

Implementation of defense-in-depth for the Project is accomplished by the *Implementing Standard for Defense In Depth*.

3.2 Safety Responsibilities

BNI recognizes its corporate responsibility for safety during the design, construction, and commissioning (DC&C) phase of the project. Safety responsibilities are assigned to and by the Project Manager. The DC&C responsibilities are assigned to functional areas as shown in ISMP Tables 9-1 through 9-3. The roles assigned to organizations are provided in ISMP Chapter 11.0, “Organization Roles, Responsibilities, and Authorities”. By these assignments, facility safety becomes a facility-wide responsibility with safety responsibilities identified for each functional area.

In addition, by these assignments, assurance is provided that the roles identified in the Safety Analysis Reports are carried out.

The Facility design is based on the design and operational experience gained at other nuclear and chemical facilities. As such, the potential hazards are well understood and lessons learned from earlier facilities are applied.

Part of the preparatory work for hazard identification studies is to review safety and incident reports from similar operating facilities to ensure that credible events are considered at an early stage in the design. For the RPP-WTP, the operating histories of Sellafield’s Vitrification Plants, Site Ion Exchange Plant, the Enhanced Actinide Removal Plant, the Savannah River Project, and the Hanford Site plants are reviewed to take account of their operating experience. In this way, lessons learned are incorporated into the RPP-WTP design and plans for operation. One such example is ion exchange resin stability. An explosion occurred at the Hanford Z-Plant because of contact between an organic ion exchange resin and strong nitric acid (HRC 1976). Because the RPP-WTP uses both organic ion exchange resins and strong nitric acid within its processes, careful consideration is being given to design of ion exchange resin handling and storage for the RPP-WTP. Section 4.4.1, “Comparison to the Hazards Analysis Results of Other Facilities”, of the Hazard Analysis Report (HAR) provides a discussion of the application of lessons learned at other facilities to the Facility process hazards analysis (PHA) and design.

3.3 Authorization Basis

In this section, the content, control, and update of the authorization basis are discussed. The authorization basis is the composite of information provided by a Contractor in response to radiological, nuclear, and process safety requirements that is the basis on which the DOE grants permission to perform regulated activities.

3.3.1 Content of the Authorization Basis

The authorization basis for RPP-WTP includes the documentation discussed in the following sections. This documentation includes that information submitted in connection with a request for Standards Approval, a request for Construction Authorization, or a request for Operations Authorization as described in DOE/RL-96-0003, *DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, and any other information submitted by BNI in connection with these requests (DOE-RL 1996a). Amendments to this information may be in the form of revisions to the previously submitted documents, or new information that supplements previously submitted information. The authorization basis begins at the Standards Approval regulatory action and continues throughout the design, constructions, operation, and deactivation of the RPP-WTP. The following Sections 3.3.1.1 through 3.3.1.8 delineate the elements of the authorization basis.

3.3.1.1 Integrated Safety Management Plan

The ISMP defines the process by which applicable laws, regulations, and standards are incorporated into design, procedures, and training to ensure adequate safety of the public, workers, and the environment. Further detail is provided in ISMP Section 1.1, “Introduction”.

3.3.1.2 Safety Requirements Document

The Safety Requirements Documents (SRD) defines the radiological, nuclear, and process safety objectives and standards ensuring the RPP-WTP is designed, constructed, operated, and deactivated in a manner that protects the health and safety of the public and workers and protection of the environment. These safety objectives and standards (SRD Safety Criteria), are included as a part of the RPP-WTP authorization basis to establish a formal agreement with the regulator on the necessary facility design features and management processes and the expectations on the features and processes required to safely achieve the defined work of processing Hanford tank waste. The “Radiological Exposure Standards for the Project” is included in the SRD.

Additional information on the SRD is provided in ISMP Section 4.1, “Safety Management Processes”.

3.3.1.3 Safety Analysis Reports

The Safety Analysis Reports (SAR) document the safety analysis for the facility to demonstrate that it can be safely operated, maintained, and shut down. The Initial Safety Analysis Report (ISAR) was developed during Part A based upon a conceptual design of the facility. Those portions of the ISAR that relate to the fundamental aspects of design are considered to be part of the authorization basis. The Preliminary Safety Analysis Report (PSAR) is based on the facility design and plans for construction and demonstrates adequate planning for the operational phase. The Final Safety Analysis Report (FSAR) documents the completed design and construction and provides details on the plans for operation. The FSAR includes facility and process drawings and fabrication and construction specifications important to the safety analysis of the facility. Specifications and drawings not submitted to the regulator are not part of the authorization basis. The FSAR identifies significant changes made in the facility design and plans for operation from what was presented in the PSAR. Near the end of waste processing activities, FSAR Chapter 11.0, "Deactivation and Decommissioning", is expanded as necessary to discuss the RPP-WTP operating history as it affects deactivation, the hazards associated with deactivation, and the condition of the facility when it is turned over to DOE for decontamination and decommissioning.

3.3.1.4 Technical Safety Requirements (TSR)

The TSRs are based on the accident analyses included in the FSAR as related to protection of the public and workers from chemical and radiological exposures. The TSRs are maintained current so that they reflect the RPP-WTP as it is analyzed in the FSAR. It includes items in the following categories:

1) Safety limits
2) Limiting conditions for operation
3) Surveillance requirements

The limiting conditions for operation are based on the following:

1) Process variables, design features, and operating restrictions that are the initial conditions for accident analysis
2) SSCs that must function to prevent or mitigate accidents to achieve compliance to public and worker radiological and chemical exposure

The detailed content of the TSRs is prepared in accordance with Safety Criterion 9.2-3 of SRD Volume II.

The TSR Bases is a supporting document that describes the basis for the individual technical requirement (excluding administrative controls) but is not a part of the TSR.

3.3.1.5 Quality Assurance Program (QAP)

The QA Program is organized to meet the requirements of 10 CFR 830.120, principles stipulated in *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006 (DOE-RL 1996b), and the specific contract requirements for QA. The RPP-WTP Project QAP document (i.e., BNFL-5193-QAP-01, Revision 8) was restructured to reflect BNI QA program policy, as well as use of NQA-1-1989 (ASME 1989), QARD (DOE 2000), and DOE Order 414.1A (DOE 1999). The restructured QAP document was issued as the RPP-WTP Project *Quality Assurance Manual* (QAM) (BNI 2001). This QAM serves as the Authorization Basis document for implementation of the Project QA program. The QAP, as described in the QAM, provides assurance that the design, procurement, construction, testing, inspection, operation, deactivation, waste form qualification, modification, and maintenance activities conducted at the facility conform to regulatory and contractual requirements and reflect best industry practices. To support meeting project radiological, nuclear, and process safety requirements, the QAP complies with elements of NQA-1 (ASME 1989), as defined in the QAM.

The provisions of the Quality Assurance Requirements and Description document DOE/RW/0333P will be applied to QL-1 and QL-2 items and activities associated with HLW services from design through production and acceptance.

The objectives of the Project QAP are to:

a) establish the project organizational structure, management controls, functional responsibilities, levels of authority, and interfaces for managing, performing, and assessing the work; and
b) ensure confidence in the safe completion of project work in full compliance with radiological, nuclear, and process safety requirements, waste product acceptance quality requirements, and mission objectives.

Adherence to the DOE-approved QAP also ensures the following.

1) DOE mission and objectives related to Project are effectively accomplished.
2) Products and services are safe, reliable, and meet or exceed the requirements and expectations of the user.
3) Hazards to the public and workers are minimized.

The extent to which quality requirements are applied to the Project is based on a graded approach, reflecting the safety implications of the activity. Quality-related activities performed by organizations providing equipment, services, or support to the Project are conducted in accordance with the requirements documented in the approved QAP.

Additional information on the QAP is provided in ISMP Section 3.5, “Quality Assurance Program (QAP)”. Additional information on the audit and management assessment aspect of the QAP is provided in ISMP Section 5.4, “Compliance Audits”, and Chapter 10.0, “Assessments”.

3.3.1.6 Radiation Protection Program (RPP)

The occupational RPP documents the program standards, requirements, administrative controls, responsibilities, and authorities associated with the scope of RPP-WTP radiological activities. The RPP is the program required by 10 CFR 835, "Occupational Radiation Protection". The RPP provides the regulatory technical basis that ensures the radiological safety of facility workers, collocated workers, facility visitors, and the onsite members of the public. Additional information on the RPP is provided in ISMP Section 2.3, "Compliance with 10 CFR 835, Occupational Radiation Protection".

3.3.1.7 Emergency Plan

The Emergency Plan, describing the provisions for responses to operational emergencies, documents the Emergency Management Program. All aspects of the Project Emergency Management Program (EMP) as required by DOE and applicable federal, state, and local requirements are addressed. The EMP, an element of an integrated and comprehensive DOE Emergency Management System (EMS) (DOE 1995a), is designed to address emergency planning, preparedness, response, recovery, and readiness assurance activities. The DOE system considers emergency conditions that might place individuals at risk; which goes beyond radiological hazards. In addition, the relationships of the EMP to existing DOE Headquarters, DOE Richland Operations Office, and Hanford Site Contractors' programs, are documented in the Project Emergency Plan. A discussion of critical interfaces and the division of responsibility among these different agencies is included in the Emergency Plan. The elements of the Emergency Plan are designed to ensure that the Project, as part of the overall DOE EMS, is prepared to respond promptly, efficiently, and effectively to any emergency to protect the public and workers.

The Emergency Plan ensures that emergency response requirements are considered throughout the planning and design process. Emergency drills and exercises are performed to evaluate the emergency plans and RPP-WTP staff response to offnormal conditions. The exercise program includes coordination with Hanford Site, state, and local emergency response organizations. The Project will participate in Hanford Site exercises and drills for other facilities as invited.

The Emergency Plan is submitted to support the request for an operating authorization. Chapter 9.0, "Emergency Management", of the PSAR will address emergency preparedness as required to support the construction authorization request. Procedures developed by the RPP-WTP construction manager implement state and federal emergency preparedness requirements for hazardous situations that may arise during construction.

Additional information on the Emergency Plan is provided in ISMP Section 3.10, "Emergency Preparedness".

3.3.1.8 Other Information

Other documents generated by the regulator or BNI may become part of the authorization basis for the Project. This includes correspondence concerning the safety aspects of the facility design, construction, operation, and plans for deactivation. Those portions specified in Appendix E of the Part A Hazard Analysis Report (HAR) that constitute bounding or significant hazards or hazardous situations are considered to be part of the authorization basis.

3.3.2 Control of the Authorization Basis

The authorization basis for RPP-WTP is considered as an element of the technical baseline for the facility. Changes to the technical baseline are managed by a configuration management program. For further information concerning configuration management see ISMP Sections 1.3.16 and 5.3, "Configuration Management".

3.3.3 Changes to the Authorization Basis

Changes to the authorization basis include changes to the facility design and administrative controls (e.g., procedures, programs, plans, or management processes) that are described in the authorization basis or are relied on to ensure conformance to the authorization basis. Changes to the authorization basis are managed by a configuration management program discussed in ISMP Sections 1.3.16 and 5.3, "Configuration Management". As described in these sections, the change management program includes the use of qualified personnel, procedures developed and approved under the Project procedure process, and implementation under the approved QAP.

By 10 CFR 830.120(b)(3), a contractor may, at any time, make changes to the approved QAP so long as the QAP, as changed, will continue to satisfy the requirements of 10 CFR 830.120. For the Project the commitment has been made that changes that reduce commitments to a previously approved QAP, as described in the QAM, will be submitted to the DOE for review and approval per the QAM requirements for its change. Annual submittal of the QAM to DOE must also identify the changes, the pages affected, the reason for the changes, and the basis for concluding that the revised QAP continues to satisfy the requirements of 10 CFR 830.120.

As allowed by 10 CFR 835.101(I) BNI may make changes to the approved RPP so long as the change does not decrease the effectiveness of the RPP and the RPP, as changed, continues to meet the requirements of 10 CFR 835. Proposed changes that decrease the effectiveness of the RPP are not implemented without submittal to and approval by DOE. Updates to the RPP are required if a change or addition is made to the RPP. Updates of the RPP are considered approved 180 days after submittal unless rejected by the regulator.

In accordance with *DOE Position on Contractor Initiated Changes to the Authorization Basis*, RL/REG-97-13 (DOE-RL 2000), BNI may make changes to the facility or administrative controls if a review of the Authorization Basis is performed and either:

a) The review demonstrates that a proposed change is consistent with the existing Authorization Basis, or

b) The Authorization Basis is revised prior to the implementation of the proposed change.

3.3.3.1 Authorization Basis Revisions

BNI may make revisions to the authorization basis, other than to the QAP and RPP as discussed above, without prior approval of the DOE provided that the following safety evaluation and documentation requirements are met:

a. An evaluation is performed that demonstrates that the revision:

   1) Does not involve deletion or modification of a standard previously identified or established in the approved SRD.

   2) Does not involve a modification of an approved Technical Safety Requirement.

   3) Does not result in a reduction of a commitment described in the Authorization Basis.

   4) Does not result in a reduction in the effectiveness of any program, procedure, or plan described in the Authorization Basis.

   5) Does not result in an Unreviewed Safety Question (USQ), if a Production Operations Authorization has been issued.

b. A written evaluation is performed that demonstrates that the revisions to the authorization basis:

   1) Will continue to comply with all applicable laws and regulations, conform to top-level safety standards, and provide adequate safety.

   2) Will continue to conform to the original submittal requirements associated with the authorization basis document(s) affected by the revision.

   3) Will not result in inconsistencies with other commitments and descriptions contained in the authorization basis or an authorization agreement.

   The format, content, and level of detail associated with an acceptable "safety evaluation" is highly dependent on the nature of the proposed revision to the authorization basis. Rather than establishing comprehensive guidance on appropriate evaluation format, content, and level of detail, the position identifies the most fundamental basis that can applied to evaluating proposed revisions. There is a wide range of acceptable safety evaluation approaches. Also, the appropriate degree of rigor and documentation associated with the safety evaluation should be tailored to the specific authorization basis revision. The position does not indicate that an explicit and detailed case be made and documented showing that the fundamental criteria have been satisfied for all revisions to the authorization basis.

c. The following documentation requirements are met:

   1) All changes, authorization basis revisions, and associated evaluations performed in accordance with paragraphs a and b above will be documented.

   2) Documentation will be retained and readily available for DOE review.

   3) Evaluations should be documented in sufficient detail such that a knowledgeable individual reviewing the evaluation can identify the technical issues considered during the evaluation and the basis for the determinations.

   4) The DOE will be notified of revisions to the authorization basis within 30 days of completing such revision.

3.3.3.2 Authorization Basis Amendments

An authorization basis revision that does not meet the conditions of subsection 3.3.3.1 paragraph a but meets the conditions of subsection 3.3.3.1 paragraph b may be implemented following approval by the DOE of a request to amend the authorization basis. A request to amend the authorization basis includes:

1) A description of the proposed revision
2) The reason for the proposed revision
3) A descriptions of the proposed implementation schedule for the revision and associated change(s)
4) A copy of the authorization basis document or appropriate excerpt showing the proposed revision(s)
5) The safety evaluation for the proposed revision, as described in subsection 3.3.3.1 paragraphs a and b
6) If the revision involves the deletion or modification of a standard previously identified in the approved SRD, certification that the revised SRD will continue to identify a set of standards that will provide adequate safety, comply with all applicable laws and regulations, and conform to the top-level safety standards.

3.3.3.3 Decisions to Deviate from the Authorization Basis

During the design and construction phase prior to the Start of Cold-Testing, BNI may implement design changes that deviate from the Authorization Basis, provided that the provisions of paragraphs 1, 2, and 3 below are met.

1. Evaluation

   Prior to implementing a change that deviates from the Authorization Basis, BNI will perform an evaluation that determines that:

   a. The change complies with applicable laws and regulations, conforms with top-level safety standards, and satisfies the SRD Safety Criteria.

   b. The specific changes will not cause or threaten imminent danger to the workers, the public, or the environment from radiological, nuclear, or chemical hazards.

2. Documentation of Decision to Deviate from the Authorization Basis

   Documentation of BNI's decision to deviate from the Authorization Basis will be completed prior to implementing the change and will include the following:

   a. Identification of the specific changes to be implemented.

   b. Identification of the specific deviation(s) from the Authorization Basis.

   c. The evaluation described in paragraph 1.

   d. The signature of the manager(s) having the authority to approve changes that deviate from the Authorization Basis and the date such changes were approved.

   Such documentation will be readily retrievable and made available to the DOE upon request.

3. Time Limits and Notification

   a. During the construction phase, if prior approval by the DOE is required, BNI will notify the DOE (or his/her designee):

      1) either verbally or in writing within 24 hours of the decision to deviate from the Authorization Basis (as recorded in 2.d above), and

      2) in writing within 72 hours of the decision to deviate from the Authorization Basis (as recorded in paragraph 2.d above). This notification will include a copy of the documentation of the decision to deviate from the Authorization Basis described in paragraph 2 above.

   b. If prior approval by the DOE is not required, BNI will revise the Authorization Basis within 30 days following the decision to deviate from the Authorization Basis (as recorded in 2.d above) and notify the DOE within 30 days of completing such revision.

   c. If prior approval by the DOE is required, BNI will submit a request to amend the Authorization Basis to the DOE within 30 days following the decision to deviate from the Authorization Basis (as recorded in 2.d above).

   d. If provisions 3.b or 3.c are not met, or if approval of the amendment request is not obtained within 90 days of the decision to deviate from the Authorization Basis (as recorded in paragraph 2.d above):

      1) All physical work associated with implementing the change that deviates from the Authorization Basis will stop, and

      2) Corrective action will be initiated immediately, in accordance with paragraph 4 below.

4. Tracking and Resolution of Deviations from the Authorization Basis

   Changes that deviate from the Authorization Basis will be entered into the project's Corrective Action Management System (CAMS) as a condition adverse to quality, as described in the QAP. If the provisions of paragraph 3.d are invoked, the change will be recorded as a significant condition adverse to quality, and corrective action will be tracked to completion. CAMS records related to deviations from the AB will be uniquely identified to facilitate retrieval and generation of reports of the current status of such deviations upon request by the DOE.

   All revisions to the Authorization Basis associated with approved Authorization Basis deviations will be completed and all deficiencies documented under paragraph 2 will be resolved prior to Start of Cold-Testing.

3.4 Safety/Quality Culture

The BNI team understands the importance of a strong safety and quality culture in achieving excellence. To achieve a culture in which individuals involved in safety-related activities accept responsibility for the safety and quality through all phases of the Project, BNI establishes the following policy:

1) Outlining expectations and performance standards
2) Communicating those expectations
3) Implementing procedures that facilitate achieving expectations
4) Performing assessments to measure the compliance with and the appropriateness of BNI safety goals.

To achieve safety and quality throughout design, construction, and operation of the facility, BNI establishes measurable goals in the areas of industrial health and safety of workers, radiological and chemical exposure limits for the public and workers, and environmental release limits. The team then establishes policies that require the communication of the goals to employees and contractors. Communication techniques include posters, meetings, newsletters, recognition of outstanding performance, and incorporation of the goals into performance plans for groups and individuals. Another important aspect of communication is training. Employees are provided information regarding the inherent hazards of the work and tools effective in controlling the hazards or responding to hazardous situations encountered during the work processes. Managers and supervisors are expected to be familiar with the work processes and to understand the potential hazards and hazardous situations.

Other policies that establish standards of conduct and job site work rules are communicated to employees. The policies empower RPP-WTP employees to stop the activity in which they are involved if the work procedure or process is not clear or the activity appears unsafe. The policies also direct that performance reviews emphasize the requirements for safety and quality.

The safe completion of a quality job requires planning that takes into consideration aspects such as adequate work packages, appropriate level of instructions, evaluation of the impact of the task on other SSCs or processes, and an evaluation of the completed activity. Procedures governing these activities specify that trained and qualified personnel are required to participate in planning process. This includes craft and operations personnel supporting technical and administrative workers.

To ensure that safety and quality procedures are being followed and that the implemented procedures are adequate to facilitate achieving the expectations, assessments of work activities performed and the results of compliance with goals are conducted. Where practices are identified that improve safety and quality, those practices are incorporated into operations. Any required corrective actions identified are tracked to completion. Results of these assessments are provided to managers and workers.

As the project moves through design and operations to deactivation, the BNI team revises the goals and procedures to reflect the activities required for each phase.

3.5 Quality Assurance Program (QAP)

The Project QAP for all activities meets the criteria of 10 CFR 830.120, "Quality Assurance Requirements". Implementation of 10 CFR 830.120 is addressed in ISMP Section 2.2, "Compliance with 10 CFR 830.120, "Quality Assurance Requirements".

Integration of the QAP into the Project safety approach began with the PHA, SRD, and HAR developed by specific procedures in accordance with the requirements of the QAP. This included the establishment of personnel training and qualification requirements, confirmation that personnel met the training and qualification requirements, application of technical review, and documentation of results. The performance of the accident analysis and the comparison of the results of the analysis to the radiological and chemical exposure standards is also performed in accordance with the requirements of the QAP. This includes training and qualification requirements; computer code verification; independent review of input assumptions, analytical methods, and calculations; maintenance of a calculation log; and documentation of the results.

The application of the QAP to design, procurement, construction, testing, inspection, modification, and maintenance of SSCs credited with public and worker safety is discussed in the QAP. The manner in which requirements of the QAP are imposed on subcontractors is discussed in ISMP Section 5.2, "Control of Subcontractors".

Personnel training and qualification and procedure development credited for public and worker safety during facility operation are developed in accordance with the requirements of the QAP. The QAP is applied to the Emergency Management Program in the areas of training and qualification of emergency response team members, assessment of the program effectiveness, and records documentation. Additional details on these aspects of the emergency response program are provided in ISAR Chapter 9.0, "Emergency Management".

Project compliance with DOE/RW-0333P, *Quality Assurance Requirements and Descriptions for the Civilian Radioactive Waste Management Program (QARD)* (DOE 1995b) is addressed in ISMP Section 3.3.1.5 "Quality Assurance Program (QAP)". The provisions of the Quality Assurance Requirements and Description document DOE/RW/0333P will be applied as described in the QAP.

ISMP Section 5.3, "Configuration Management", Section 5.4, "Compliance Audits", and Section 8.0, "Document Control and Maintenance" provide additional information on the application of the QAP to the Project safety approach.

3.6 Facility Design for Postulated Events

This section describes the facility design for normal operation, anticipated operational occurrences, and accident conditions.

3.6.1 Normal Operations

The facility design provides for control of radiological exposure to the public and worker such that the exposures are within the standards provided in Table 1-2 for normal events. In addition, the design satisfies the Operations Risk Goal of *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors*, DOE/RL-96-0006 (DOE-RL 1996b) and of SRD Volume II, Safety Criterion 1.0-4. Those SSCs required for achieving compliance with the public and worker exposure standards for normal operation are designated as Important-to-Safety Safety Design Significant as discussed in ISMP Section 1.3.10, "Classification of Structures, Systems, and Components".

The process follows a logical approach, beginning with defining the basis of design and developing the overall process flowsheet. System-specific flow diagrams, such as ventilation flow diagrams, are also developed if required. The next stage is the production of operation and maintenance philosophy documents for each area of the facility, tied together by an overall control philosophy document. These documents define the design principles for each area and allow specific equipment selection or design to commence. These principles are based on existing successful operation of structures, systems, and components. However, where a new process or system that has the potential to provide a cost-effective and safe alternative is identified, a research and development program is initiated to support the design process.

Flow diagrams and documents are subject to review during their development, addressing different aspects of the design. The Technical Organization ensures a consistent design approach is taken across the project and that all of the project requirements are being addressed. The PHA team, which includes representatives from operations, reliability, and relevant technical disciplines, addresses each component of the design from a safety and operability aspect.

This process is used at the RPP-WTP to ensure that safe, efficient operation is built in at the design stage. Application of this process is demonstrated in various philosophy documents and plant layouts that describe features to be used in the RPP-WTP. The following is a list of these features:

1) Fluidic devices (pumps and valves) that contain no moving parts are used to transport and divert highly radioactive liquids. These items require no maintenance
2) Fully welded pipework systems minimize the risk of leakage
3) Automated sampling and transport systems allow efficient process operations while minimizing radiation exposure to workers
4) Canister HEPA (high efficiency particulate air) filters ease handling and installation operations.

The type of control identified through the design process for the RPP-WTP also leads to the reduction of the risk to public and workers while allowing efficient process operation. The distributed control system allows the facility to be operated under normal conditions from a central control room, thus reducing radiological exposure to personnel. Hardwired backup systems are used for some safety systems that are totally independent from the operational control system.

The close relationship between Hanford tank farms operations and the RPP-WTP may require additional administrative controls and documentation in support of AP-106 operations (e.g., master pump shutdown). Such concerns are addressed and resolved at a site-wide level through interface control meetings.

3.6.2 Anticipated Operational Occurrences

The RPP-WTP will have anticipated operational occurrences that are not considered part of the normal process operation. Certain features are built into the design to minimize the risk to personnel, the impact to the process operation, and to enable equipment to be maintained in a safe manner during normal operation and anticipated operational occurrence. Examples of these features include the following:

1) Flasking systems that allow maintainable plant items to be removed from the cell environment and taken to specifically designed maintenance areas
2) Cell bulge systems that enable equipment to be safely maintained without needing to enter the high radiation level cell confinement
3) Standby filtration systems that allows filters to be changed offline
4) Distributed control system that contains a dedicated mode that is interlocked to prevent the maintenance of an item until it is fully isolated.

3.6.3 Accidents

During postulated accidents, the RPP-WTP is designed to maintain confinement of radioactive materials, thus preventing a significant release from the facility.

During facility design evolution, hazardous situations identified by the PHA and the accident consequence analysis are compared to the radiological and chemical exposure standards provided in SRD Safety Criteria 2.0-1 and 2.0-2. Hazardous situations considered include both internal and external events. If the radiological or chemical exposure standards are not satisfied, the need for engineered or administrative controls to prevent or limit the release is addressed. Preference is given to engineered features over administrative controls.

Hazardous situations considered include both internal and external events. The HAR Section 5.0, “Hazard Evaluation by Process Step”, discusses the internal events and HAR Section 2.1, “Site Description”, discusses external events. The ISAR Chapter 4.0, “Integrated Safety Analysis”, presents additional consideration given to internal and external events.

The engineered features are designed and maintained to the highest applicable standards to ensure their functional performance in the prevention and mitigation of accidents. Recognized and accepted consensus codes and standards are used. Features credited for satisfying the public and worker radiological and chemical exposure standards of SRD Safety Criteria 2.0-1 and 2.0-2 are classified as Safety Design Class. Details on the classification process and the quality assurance provisions provided for each classification are provided in ISMP Section 1.3.10, “Classification of Structures, Systems, and Components”, and Section 1.3.11, “Quality Levels”. Additional information on the design of SSCs credited for worker and public protection is provided in ISMP Sections 3.1, “Defense-in-Depth”, 3.7, “Proven Engineering Practices”, and 3.11, “Safety Systems Design”.

A specific list of SSCs credited for worker and public protection is provided in ISAR Section 4.8, "Controls for the Prevention and Mitigation of Accidents". These SSCs are identified in the master equipment list, which is maintained by the Configuration Management Program as discussed in ISMP Section 5.3, "Configuration Management".

3.7 Proven Engineering Practices

The RPP-WTP design incorporates the use of proven technologies so that lessons learned from the use of the technology is incorporated into the operation of the facility. For the novel uses of existing technologies (such as the use of specific ion exchange resins), the PHA ensures that the safety aspects are examined in a structured research and development program to be assured that hazard potentials are reduced as far as practicable or that protection put in place is commensurate with the assessed magnitude of the hazard.

Facility processes are based on selected technologies that minimize the risk of radiological and chemical exposure. For example, sampling and maintenance activities do not require breach of confinement; hands-on maintainable items within active areas are accessible via shielded access areas that have decontamination facilities installed; and samples with high activity levels are dispensed and transported remotely.

New and novel uses of existing technologies and processes are employed to enhance the process while maintaining safe operation. These uses (e.g., selection of ion exchange resins and the melter feed processes) are examined through a program of research and development. Such development work includes operating a pilot (cold operation) melter and associated feed and mechanical handling systems. This prototype is used to examine and prove novel processes, test the design and maintainability of components, and provide operator training in operational and maintenance activities. To support the use of new and novel uses of existing technologies and processes and new equipment, it may be necessary to develop ad hoc standards. The use of ad hoc standards is discussed in SRD Volume I, Section 3.4.2, "Identification of Consensus Codes and Standards".

The RPP-WTP design incorporates passive and active engineered features that prevent and mitigate the potential for radiological and chemical exposures to the public, worker, and the environment. In the selection of required controls, preference is given to accident prevention over mitigation and engineered features over administrative controls. Preference is also given to passive engineered features over active engineered features. The designation of safety features is made during the hazard evaluation and accident analysis processes.

Examples of passive and active features are described in the following sections.

3.7.1 Passive Features

Facility processes are confined by at least two barriers. Facility and process equipment provides the first barrier and a cell or similar enclosure provides the second. This secondary confinement barrier has appropriate levels of shielding to ensure that radiological exposure does not exceed standards. Confinement and shielding design are established, as are the codes and standards that are used. Aspects of confinement design ensure that failure of one barrier does not lead to failure of the other (i.e., confinement is diverse). For example, should a process vessel or pipework leak (loss of primary confinement), the liquor drains to the cell sump where it can be recovered. The cell is lined to prevent liquor leakage. The potential for failure of a process vessel or piping is reduced by the selection materials resistant to erosion and corrosion and the use of direct inspection or erosion/corrosion coupons as discussed in Section 3.13, "Reliability, Availability, Maintainability, and Inspectability (RAMI)".

3.7.2 Active Features

The facility ventilation systems are designed to minimize the potential for radiological and chemical release into or out of the facility. The air flow into the facility is drawn through areas designated as having low or no potential for radiological or chemical release, through areas of successively higher potential. Except for the facility ventilation systems serving areas evaluated as having marginal potential for radiological contamination, this air is then filtered before release. Ventilation systems are exhausted to the atmosphere via monitored stacks. The principles behind the design and the systems employed are tried and tested components. Additionally, important to safety ventilation systems contain redundant equipment (fans, filters, electrical supply) to protect against single active failures.

The selection of facility equipment required to perform a safety function is based on proven design. The safety performance function requires that suitable testing and maintenance regimes are in place to ensure reliability. For example, where programmable logic controllers are used, specific attention is given to their unique requirements relative to software verification and protection against electromagnetic interference (See SRD Safety Criterion 4.3-1).

Protection systems are an integral part of defense-in-depth as described in ISMP Section 3.1, "Defense-in-Depth".

Preference is given in the facility design to components failing in their safe position on loss of motive power. During the design process, the failure modes of safety features are determined and specified. Simple and proven items of equipment (e.g., valves and pumps) are used, the (required) failure modes of which are well understood and categorized.

3.8 Criticality Safety

A criticality event within a nuclear chemical facility can have severe consequences; therefore, the preferred approach is to preclude the possibility of the hazard by the use of design features. Where this cannot be achieved (because of the presence of a large mass of fissile material within the process) or is impracticable, stringent criticality controls are required. Handling large amounts of fissile material (as in plutonium finishing), criticality control is achieved through a combination of geometry, inventory control, concentration (for solutions), moderation, and suitable instrumentation backed up by administrative controls. The need for these controls is established during the design phase by considering worst-case scenarios and applying conservative assumptions. Worst-case scenarios are modeled using validated computer codes to determine system reactivities and the degree of criticality control required.

The modeling and worst-case scenarios include considerations for uncertainties in the data and calculation methods, uncertainties in the immediate environment under accident conditions, and the presence of water moderation and reflections unless the presence of water is shown to not be credible. The analysis will show that the multiplication factor, k_{eff}, will not exceed 0.95 at a 95% confidence level for credible normal, off-normal, and accident conditions. Exceeding a multiplication factor of 0.95 is prevented by either the control of two independent process parameters, or a system of multiple controls on a single process parameter. This is application of the double contingency principle.

This methodology has also been applied to the RPP-WTP process. The amount of fissile material present in the contract feed has been conservatively estimated, then modeled under process conditions using conservative assumptions. The application of this methodology indicates there is insufficient concentration of fissile material to give rise to a significant potential for criticality within the RPP-WTP. The results of this preliminary analysis are provided in ISAR Chapter 6.0, “Nuclear Criticality Safety”. If any significant potential for criticality becomes apparent, appropriate controls will be implemented commensurate with the assessed potential. Additional detail regarding criticality prevention are provided in ISAR Chapter 6.0, “Nuclear Criticality Safety”.

The RPP-WTP criticality program includes the following:

1) Establishment and maintenance of controls needed to ensure that material specification for proposed feed to the facility are fully compatible with the process and are within the fissile material content bounds of the criticality assessments
2) Performance of nuclear criticality safety assessments when and where appropriate to ensure that changes do not occur that impact assumptions made in criticality evaluations
3) Maintaining appropriate access to trained nuclear criticality experts.

The need for criticality alarms is determined by evaluation to the requirements of Safety Criterion 3.3-6 of SRD Volume II. Alarms, if required by this criterion, are installed in accordance with Safety Criteria 3.3-7 and 3.3-8.

3.9 Radiation Protection Practices

The radiation protection design practice for normal operations at the Project consist of two main elements, radiation protection design and as low as is reasonably achievable (ALARA) design. These design practices ensure that the RPP-WTP can be operated in a manner that maintains normal occupational exposures and emissions of radioactive effluents within limits and ALARA. The radiation design process also considers features to facilitate deactivation and decommissioning of the facility and will be applied to the deactivation planning near the end of waste processing operations.

3.9.1 Radiation Protection Design

Radiation protection design addresses material confinement, shielding and access control features, and monitoring. Each of these is addressed in the following sections.

3.9.1.1 Radioactive Material Confinement

Confinement systems present barriers to the uncontrolled release of radioactive material and against the spread of contamination through the RPP-WTP. For the facility, the process vessels and piping and the process vessel ventilation system provide the primary confinement barrier. The process cell structures and associated ventilation system provide the secondary confinement barrier. The operating area structures and associated ventilation systems provide a tertiary confinement barrier. Ventilation flow is from areas of lower potential contamination to areas of higher potential contamination. The effluents are treated as necessary to control exposures to collocated workers and members of the public during normal operations and under accident conditions.

Throughout the RPP-WTP confinement barrier, boundaries are identified and design criteria established for these boundaries and for the associated ventilation systems. Design documents covering the confinement systems are reviewed to ensure the design criteria are adequately implemented.

The confinement systems under normal operations are assessed based on upper-bound conditions identified in the PHA. The projected annual radiological exposure from normal operations is compared against the criteria provided in SRD Volume II, Chapter 2.0, “Radiological and Process Standards”, and facility features are modified and added to the facility as necessary to meet the criteria (BNFL 1997d).

3.9.1.2 Radiation Shielding and Access Control Features

The RPP-WTP is divided into radiation zones. The zoning reflects the intensity of the radiation sources in the area, if any, and the anticipated personnel access requirements. Maximum allowable exposure rates in accessible areas are defined to ensure that personnel exposure standards are not exceeded. Shielding requirements are then established as necessary to ensure that the exposure rates in the radiation zones are maintained under all anticipated operating conditions and that commitments to ALARA are satisfied. Shielding and access control features are provided in accordance with 10 CFR 835 and additional criteria provided in SRD Volume II, Chapter 2.0, “Radiological and Process Standards”, and Chapter 5.0 “Radiation Protection” (BNFL 1997d).

Radiation protection features such as facility zoning, minimum shielding requirements, and access control features will be documented on applicable facility layout drawings and other design documents. These documents are reviewed to ensure that the requirements are met. Details, such as penetrations are analyzed to ensure that potential streaming paths are identified and properly shielded.

3.9.1.3 Radiation Monitoring

Fixed area radiation monitoring is provided in areas where the area exposure rates may change suddenly. These sudden changes may be a result of process operation or maintenance activities. Continuous air monitors are provided in accessible locations where concentrations of airborne radionuclides may vary. Air sampling capability is also provided. Effluent sampling is provided as necessary to demonstrate compliance with regulations. The radiation monitoring locations will be shown on drawings developed during detailed design.

3.9.2 ALARA Design

Project procedures are established to implement an ALARA program. These procedures include guidance on ALARA design considerations appropriate to the facility and delineate the ALARA design responsibilities of individuals on the project. The ALARA guidance is derived from federal and commercial nuclear operating experience as well as from industry standards such as NRC Regulatory Guide 8.8, *Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be As Low as is Reasonably Achievable* (NRC 1978) and DOE G 441.1-2, *Occupational ALARA Program Guide*. The ALARA guidance addresses considerations for reducing exposures within the RPP-WTP from operations and from final decommissioning activities. It also addresses considerations for reducing effluents from the RPP-WTP.

ALARA design criteria and ALARA design considerations are provided to project staff in controlled documents. These criteria and considerations are arranged by topic area (for example, General Criteria, Dose Criteria, Environmental Criteria, Facility Arrangement Considerations, Shielding Considerations, System Design Considerations, etc.). Design engineers are responsible for implementing and documenting ALARA design criteria and ALARA design considerations in their work. Supervisors are responsible for ensuring that individuals in the group are trained in ALARA criteria and considerations, and for reviewing designs against those criteria and consideration. The WTP ALARA program also requires an ALARA review of proposed changes to the facility.

Periodic interdisciplinary project ALARA reviews are conducted to ensure that ALARA concepts are being integrated into the design and to discuss implementation of the ALARA design goal and the rationale for exceptions from specific ALARA design considerations.

In addition, collective exposure estimates assess projected exposures to provide insight into the sources of exposure and indicate areas that may require additional attention. The estimates are compared to those from similar operating facilities.

Radioactive systems at the RPP-WTP are designed to minimize the potential for leaks of radioactive material. Radioactive leaks are collected and segregated from non-radioactive waste streams. To the extent possible, radioactive leaks are returned to the process stream.

Melter offgas streams are treated to scrub out radioactive particulates before passing through filter media. The scrub streams are returned to the process stream.

The interfaces between non-radioactive service systems (e.g., cooling water) and radioactive systems are designed so that any leakage is from the clean side to the radioactive side of the interface.

The confinement system design and access control features described above serve to minimize the spread of radioactive contamination in the RPP-WTP. During operation, movement of clean materials into potentially contaminated areas is minimized to aid in contamination control, minimize replacement and survey costs, and minimize radioactive waste volumes and costs. Tools in contaminated areas are controlled and reused to the extent possible.

3.10 Emergency Preparedness

The Project implements and maintains an emergency management program to respond promptly, efficiently, and effectively to emergencies involving RPP-WTP, activities, or operations. The applicable requirements of federal, state, and local agencies are integrated into a single comprehensive program. The magnitude and scope of the emergency management program are determined by the final assessment of the hazards and hazardous situations to be completed in Part B.

The Project emergency management program is being designed to function within the existing Hanford emergency management community. Community planning partners are the DOE; DOE contractors; the Energy Northwest; U.S. Ecology; the State of Washington; and Benton, Franklin, and Grant Counties. The Project emergency management program is being developed and will be implemented to be consistent with the *Hanford Emergency Response Plan* (DOE-RL 1994), to ensure a timely and integrated response and to eliminate duplication of effort within the planning community. Agreements will be established to enable the Project to use existing Hanford response capabilities (e.g., fire, medical, hazardous materials spill response, consequence assessment, law enforcement, and communications). The facility design facilitates access and intervention by the Hanford Site fire department (e.g., the ability to connect to the interior standpipe system). The RPP-WTP Emergency Management Administrator participates in and supports Hanford Site and local area emergency planning organizations, including the Hanford Emergency Planning Council and the local Emergency Planning Committee.

The Project emergency management program is being developed for compliance with the requirements of 40 CFR 355, “Emergency Planning and Notification”, 29 CFR 1910.38, “Employee Emergency Plans and Fire Prevention Plans”, and WAC 173-303-350, “Contingency plan and emergency procedures”.

The Emergency Response Plan incorporates into one document an overview of the emergency management program for the Project. The plan provides a description of how the Project implements the provisions of all applicable requirements. RPP-WTP specific emergency implementing procedures are developed to implement the requirements of the plan.

Table 3-1 lists the information to be included in each section of the Emergency Response Plan. Additional information on the Project Emergency Management Plan is presented in ISAR Chapter 9.0, “Emergency Management”.

3.11 Safety Systems Design

For facilities designed and built by the RPP-WTP contractor, a proven method for identifying the requirements of operational and engineered protective measures is undertaken, the results of which are applied during the entire project design phase. The RPP-WTP contractor approach to facility design applies a suite of company targets to facilitate compliance with RPP-WTP contractor standards and compliance with applicable radiological exposure standards. Where practical, passive features are used rather than active features. Potential faults are minimized by a design that moves the facility towards a safe state in response to failures, or by incorporating permanently available, passive features that render the facility safe following a failure. In some cases, however, it may be necessary to incorporate active engineered features into the design of a facility that act in response to the fault to render the facility safe.

The following hierarchy of safety measures is incorporated into the RPP-WTP design.

1) Operational Preventive Measure (OPM) is a corrective action taken by an operator to terminate the development of a fault sequence. Examples include operator responses to system parameters, sampling and chemical analyses, control system indications or alarms, and procedural instructions. An OPM is considered the first line of protection against a hazard under normal facility operating conditions. Should the OPMs fail, protective systems and devices are designed to automatically operate.
2) Engineered Protection Systems operate automatically to prevent a hazard from occurring, and generally use hardwired trips, mechanical devices, or programmable electronic systems (such as programmable logic controllers) commensurate with the potential risk of the hazardous situation. If protective measures fail, a hazardous situation may occur, the consequences of which can be reduced by the action of mitigating systems.
3) Mitigating Systems attenuate the consequence of a hazardous situation once it has occurred. They include ventilation systems, radiological alarm systems, and evacuation systems.

Table 3-1 Outline And Content of Emergency Response Plan (Sheet 1)

Section Title	Content
Introduction	The purpose and scope of the plan is presented and all requirements applicable to the Project emergency response program are identified. A description of the operational use of the Emergency Plan and Emergency Plan Implementing Procedures is provided. The types of emergencies to which the Emergency Plan applies and does not apply are identified. A description of the boundaries, facilities, and site for which the Emergency Plan applies is provided. The concept on which emergency planning is based is discussed and the documents, reports, surveys, and assessments used to develop the Emergency Plan are referenced. A summary of the results of the RPP-WTP safety analysis is given.
Emergency Response Organization	The overall organizational structure of the Project, and the emergency response organization, including its relationship to the overall structure, is described. The functions, authority, and responsibility of all internal organizational elements with emergency responsibilities are delineated. The chain of command in the event of an emergency is identified. The organizational structure, authorities and responsibilities, and roles played by each position are defined and the succession of authority for each position is identified.
Offsite Response Interfaces	An overview of the relationships with offsite organizations is provided. A description of the agreements with state, federal, and other agencies, specifying the role of the agency, potential response, regulatory control, and notification chain required is provided. Also, a list of all memoranda of agreement and memoranda of understanding with offsite organizations is included.
Emergency Categorization and Classifications	The definitions of operational emergencies, emergency classes, and the criteria used to define an emergency are stated. A brief description of the methodology used to develop criteria is given and specific technical supporting documents are identified. The Emergency Action Levels (EAL) used to define an emergency are discussed. The methodology used to develop EALs is described and reference technical supporting documents are identified. The criteria for each emergency classification are stated. Personnel (positions) responsible for declaring an emergency and their required qualifications and training are identified.
Notifications and Communications	The required and proceduralized notification process for onsite and offsite notifications for all operational emergencies is discussed. Personnel (positions) responsible for both initiating and receiving notifications are identified and the methods used to perform notification are identified. The notification procedure for termination of an incident is described. Personnel (positions) required to be notified for any emergency are identified. The circumstances under which the DOE and Hanford Site contractors are notified of an emergency are discussed and descriptions of the communications interfaces with offsite organizations are provided. Equipment, back up equipment, readiness assurance, and testing procedures are identified.
Consequence Assessment	The procedure(s) used to determine the potential consequences based on the results of hazard assessments and input from other pertinent areas are described. The methodologies used for consequence assessment and referenced technical supporting documentation are identified. The procedure for coordination with federal, state, and local organizations to obtain the information necessary to make accurate and timely consequence determinations is discussed.
Protective Actions and Recovery	The purpose and intended use of protective actions are discussed. The protective actions used at the facility and under what circumstances they are implemented, modified, or terminated, and how this information is communicated, both onsite and offsite are described. A description of the provisions for implementing protective actions at the facility and for recommending protective actions to offsite agencies is included. Conditions, procedures, and authorities for the protection of local populations are identified and the size of the plume emergency planning zone is provided. Discussion of the criteria for reentering areas under emergency conditions or reentering areas that have been access-restricted during the emergency is included. Provisions to place and maintain the facility in a safe state following an accident are discussed. Personnel (and their relationship to the emergency organization) who can develop, approve and, implement reentry are identified. A description of the system to ensure safe shutdown of operations following the declaration of an emergency is given.

Table 3-1 Outline And Content of Emergency Response Plan (Sheet 2)

Section Title	Content
Emergency Medical Support	The medical capabilities available onsite and offsite (e.g., local communities) to respond to an emergency are described. The transportation and evacuation capabilities, equipment, and the process for moving contaminated and non-contaminated casualties are described. The personnel (and their positions) with the responsibility and authority to evacuate injured or ill staff are identified.
Emergency Termination and Recovery	The plan and criteria for declaring an emergency condition terminated and for transitioning to recovery activities is described. Termination authority and responsibility, recovery criteria for protection of workers and the general public from hazardous exposure, exposure guides for recovery personnel, facility accessibility (including recognition of uninhabitable areas), security considerations, access to protective clothing and equipment, availability of medical assistance, and requirements for establishing the recovery organization are identified.
Public Information	The program to provide information and answer questions concerning the emergency to workers, media, and the general public, including information release approval, is described. The facilities and communications equipment used to disseminate information to the public are identified. The education program to inform workers and the public of the dangers present, and provide information that can be used for emergency actions, including recommended evacuation routes and sheltering is discussed.
Emergency Facilities and Equipment	All primary and back up facilities to be used for emergency response and the equipment capability and limitations, quantity of equipment, locations (both fixed and portable equipment), consumables, maintenance requirements, certification requirements, expiration dates, and computer/communications compatibilities are listed and described.
Training and Drills	The goals and objectives of the training and drills program; courses given to emergency management personnel; and identification of training requirements for key emergency management positions and response teams are provided. The periodicity of courses and employee requirement for training and retraining or refresher training are identified. Also described are the system of training available to, and required for visitors, vendors, and subcontractors; the training available to offsite organizations, and supporting organizations in order to support their abilities to participate in site emergency response actions; and the system of recordkeeping to verify training requirements are met. The drill program, including the goals, frequency, complexity, and integration of lessons learned into emergency planning is described.
Exercises	The intended purpose of the exercise program is discussed. How exercises are controlled and evaluated, and how lessons learned from exercises, improvements, and/or corrective actions, are incorporated into emergency planning is described. The varying degree to which outside agencies will participate in exercises is also discussed.
Program Administration	The Project Emergency Management Program Administrator is identified. The procedure used to control the Emergency Plan and to ensure periodic review and update; and the site internal assessment program are described. The provisions for document control and records management are provided.

Application of the design standards results in a facility in which systems operate safely, with operators monitoring the systems so that actions can be taken to terminate the development of a fault sequence. However, no credit is taken for that operator response, so the facility is designed with engineered features that will function automatically to prevent the development of hazardous situations. If system operations, operator actions, and engineered features fail to preclude the event, mitigating systems are designed to attenuate the consequences of the event.

Another important aspect in safety system design is the evaluation of the conditions in which the systems are expected to operate. The design will incorporate the expected environmental conditions into the specifications for the SSCs that must function to prevent hazardous situations or mitigate the consequences of accidents. Requirements regarding the environmental qualification of Safety Design Class systems and components, including considerations for aging, are provided in SRD Volume II as Safety Criterion 4.4-2. While suppliers of Safety Design Significant systems and components are not specifically required to provide test results relative to aging, the procurement specifications for these systems and components will specify the environmental conditions (e.g., temperature, humidity, and radiation field) to be expected during normal operation and the accident duration for which the system component must function. Specifying Safety Design Significant systems and components in this manner provides reasonable assurance to DOE that they will perform their safety function when required.

The safety system design process for the RPP-WTP uses a project-wide approach for the classification of the SSCs based on their importance to accident prevention and mitigation. This approach ensures that specifications for SSCs are commensurate with the importance of the functions that need to be performed.

Safety Design Class SSCs are those necessary to ensure that the radiation and chemical exposure standards for members of the public or workers are not exceeded as a result of accidents. The Safety Design Class designation is also applied to those SSCs necessary to prevent criticality events. The highest levels of design, quality assurance, and operational requirements (e.g., periodic testing and preventative maintenance) are applied to Safety Design Class SSCs.

Safety Design Significant SSCs are those needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation. SSCs are also designated as Safety Design Significant if they place frequent demands on, or adversely affect the function of, Safety Design Class SSCs if they fail or malfunction. High levels of design, quality assurance, and operational requirements are applied to Safety Design Significant SSCs.

Additional information on the SSC classification process is provided in ISMP Section 1.3.10, “Classification of Structures, Systems, and Components”.

3.12 Human Factors

In the design of the Project, careful attention is paid at every interface between the operating personnel and the facility to ensure that good human factors and ergonomics practices are followed. This ensures the facility is user-friendly to minimize errors of omission and commission and to ensure the operator is in the best possible position to respond to those situations in which human response is beneficial or required. Attention is given to the placement of instruments and controls in the control room to ensure that clear and unambiguous indications of facility status to the operators. The acceptability of instruments placement is confirmed by constructing a physical or computer mockup of the panels prior to fabrication of the panels. This mockup ensures that compatibility with human psychology and physical characteristics is achieved and enables the required human tasks to be performed reliably and efficiently.

Human factors specialists conduct human factors reviews of training, operator capabilities, work spaces, and the design of the Safety Design Class and Safety Design Significant SSCs and functions that are judged to be critical to facility performance and that have a high potential for human error. These specialists will have many years of experience on a wide variety of nuclear or chemical facilities, including facilities similar to the RPP-WTP. During the early design phase, the specialists identify opportunities for design improvement and provide recommendations to address human factors principles and processes. The specialists conduct interviews with operations personnel from similar facilities to identify lessons-learned relative to human-machine interfaces. In addition, information from incident databases is used to identify where human-machine interfaces are contributing factors in recorded incidents. Human factors specialists are involved in the specification and use of mockups and models of instrument panels and controls rooms. These specialists are also involved in the performance of task analysis that evaluates the functions to be performed by operating and maintenance personnel against the facility design, procedures, and training.

Task analyses are carried out on operations that involve personnel and required to maintain the safety functions of the facility. This includes analyzing the demands on the operating personnel in terms of perception, decision making, and action. The analyses provide an assessment of the feasibility of the proposed tasks and an input to the design of interfaces in accordance with human capabilities. The results of such task analyses also provide the basis for the development of the design, the operating procedures, and personnel training.

Personnel with safety responsibilities are provided with expectations for their safety functions. These expectations include the responsibilities of the operations personnel who monitor and control facility response to faults as well as the responsibilities of those personnel who perform tests, maintenance, or other activities.

The design effort commences with the general layout of the facility and continues through the detailed design stages for each aspect of human involvement during the life of the facility. Adequate instrumentation in the control room and at local control stations is particularly important to allow operators to detect and correct abnormal conditions. Display systems, panel layouts, and workspace access are also important to ensure that routine and special maintenance can be completed safely.

These considerations support the formation of the basis for interactions with other aspects of human factors design, which include training, the preparation of operating instructions, the proposed staffing levels, and the implications for safety management. In this respect, training of operations personnel and other staff is influenced to ensure compatibility with the proposed facility operating regime, and the operating procedures are developed to ensure full compatibility with the design of the tasks and the design of the equipment. Operating instructions are validated for reliable interpretation and implementation by the user. The validation includes the interactions with initiating, sustaining, and terminating cues. The staffing levels are proposed based on the results of the human factors studies to ensure that adequate levels are achieved at all times.

3.13 Reliability, Availability, Maintainability, and Inspectability (RAMI)

To ensure that the facility meets operational requirements, it is necessary to address issues associated with reliability, availability, maintainability, and inspectability.

Reliability is used as a measure of the ability of an item or system to complete a task, and it is normally expressed as a probability of failure. Reliability is designed in through the use of appropriate design techniques and control of the mode of operation and the environment. Design techniques to be used vary because they are dependent on the specific item or system and the task to be performed. Their purpose is to optimize reliability by the following:

1) Use of proven materials and components
2) Design simplicity
3) Testability
4) Control of manufacturing standards
5) Control of operational mode (e.g., prevention of misuse and overloads)
6) Control of environment (e.g., protection against corrosion and vibration).

Consistent with the process for tailoring hazard controls using the potential radiological and chemical consequences of individual events, reliability is assigned to SSCs based upon the importance of the SSC to the prevention or mitigation of accidents. The significance of accident prevention and mitigation is determined by the severity of the accident to workers or the public. To implement this tailoring in a clear, consistent, and defensible manner, an Implementing Standard for Safety Standards and Requirements Identification was developed. This Implementing Standard includes a Severity Level ranking system which provides the hazard assessment and control teams with a defined way to categorize the potential severity of those events that can result in radiological or hazardous exposure to the workers or the public. The Implementing Standard provides the means by which the hazard assessment and control teams establish target reliabilities for SSCs.

Availability is a measure of the degree to which an item or system is in an operable condition. It is expressed quantitatively as the ratio of the mean time between failures to the sum of the mean time between failures and the mean time to repair. System availability is calculated to determine the potential for downtime. In this way, systems are identified that contribute to decreased availability. Required availability is achieved by specifying additional systems or increasing reliability of existing systems.

Maintainability is a measure of the ability to restore a failed item or system to an operable condition in a specified time. Maintainability is designed into the facility and processes through use of appropriate design techniques, (e.g., the use of specially designed, remotely removable, and replaceable pumps and valves in process systems, and the placement of active pumps or valves within shielded accessible areas equipped with appropriate decontamination facilities that allow hands-on maintenance activities) and logistic support (e.g., scheduling and procedures). Benefits of these design techniques are that they simplify maintenance operations in high radiation areas and remove high maintenance equipment from high radiation areas.

Testability of Safety Design Class systems and components is facilitated by such features as redundancy that allow for a system or component to be removed from service for maintenance or testing without loss of safety protection.

Inspectability is the measure of the ease with which items or systems can be inspected for preventative maintenance or assessment of condition. Inspectability is used to monitor facility items in order to maintain their reliability. Inspectability of facility items can be designed in by the use of shielded access areas (as above, to reduce radiation exposure) for active equipment or the provision of monitoring equipment (e.g., material coupons for determining vessel corrosion rates, and in-cell cameras).

During the design phase, the RPP-WTP and processes are evaluated for reliability, availability, maintainability, and inspectability. BNI uses a number of validated modeling techniques (computer codes, mathematical modeling, failure modes, and effects analysis) for determining reliability and availability of the facility and processes. These are used to identify those facility and process areas that are sensitive with respect to influencing overall facility and process performance. Optimum reliability is established by the use of appropriate standards and quality control. The determination of maintenance and inspection needs is based on facility and process reliability requirements. It is a mixture of process optimization, provision of appropriate design features to aid preventative and scheduled maintenance and inspection, and the development of maintenance and inspection programs (administrative and procedural controls) whose objectives among other things, are to facilitate these activities. Reliability targets are assigned to SSCs only when a quantitative value has been credited for the reliability of an SSC in safety analysis.

A hypothetical example of the application of RAMI to the RPP-WTP is the cooling water supply system to the technetium/cesium product storage tank. Cooling water is supplied to the this vessel to keep the contents from boiling thereby preventing the release of radionuclides and steam to the ventilation system. Failure of the cooling water system supply could lead to a hazardous situation or, at the least, operability concerns. The system comprises a closed-cycle primary system supplying chilled water to cooling coils within the vessel. Chilled water is supplied via a secondary chilled water circuit and heat exchanger. It should be noted that physical considerations indicate that the tank contents may reach their boiling temperature, but the predicted time required is on the order of several days. A conservative estimate of the minimum time to boiling assumes there is no heat transfer from the tank (ISAR Section 4.7.2.4, “Technetium/Cesium Product Storage Tank”).

This supply system is analyzed using a commercially available computer program. The system is first broken down into major components (e.g., pumps and valves); for each component reliability data are obtained and an acceptable repair time specified. The computer model calculates total availability of the system throughout the “operating life” of many years. The overall reliability of the system is then determined by application of fault tree analysis. Failure rates for postulated faults are determined and sensitive items of the system with respect to failures are identified.

No maintainability of the in-cell components (primary circuit) is required, as the design takes this into account (e.g., all welded pipework and enhanced testing). Inspection of the primary circuit takes place either indirectly through the use of coupons within the circuit to assess corrosion rates of the pipework and cooling coils or directly through visual (closed circuit television) means.

3.14 Commissioning and Operation

A structured test program ensures that SSCs function correctly against their specific performance requirements, including safety functions. The test program depends on the facility design being systemized, which allows each individual system to be fully tested in isolation before being integrated with the others leading towards full facility operation. Design documentation, such as process and system descriptions, are used as a resource to develop the startup testing program. Full facility operation is dependent on the successful demonstration of the process performed by the facility. Facility operation is not initiated until the systems testing adequately demonstrates their performance objectives in support of the process. Fault detection sooner rather than later is the philosophy to ensure cost-effective design, manufacture, and fabrication, leading to a structured design and testing methodology with the emphasis on systems analysis early in the design process. The RPP-WTP is systemized for design and procurement, allowing the BNI design and testing philosophy to be applied consistently with the Tank Farm facility.

The RPP-WTP includes chemical process and mechanical handling operations, performed by a number of mechanical, electrical, instrument, and control systems contained within a suitable civil structure. Each system is tested to demonstrate performance, as scheduled by a test plan, and is only integrated with other systems when test acceptance criteria have been met.

During testing, diagnostic data are collected, and the initial operating parameters recorded. Operating points are adjusted to conform to the design basis of the system or component. Deficiencies detected in testing are tracked to ensure their resolution.

The method of testing is predetermined to be either analysis, demonstration, or examination, depending on the function performed and the type of SSC. Testing begins at the component level. Only components that have met qualification requirements are integrated into their respective system. Each system is tested, as appropriate, with particular attention given to the system interface(s) with its associated system(s). These interfaces are simulated for the purposes of testing.

Manufactured systems and components are typically tested at their point of fabrication, and held there until proven acceptable for delivery to the construction site. All installed systems are subject to installation and startup tests, to ensure that they perform as they did at their point of manufacture, and that they have not been damaged during transit. These tests include energizing equipment and checking mechanical operation, instrument calibration, electrical cable continuity, and pipe and structural integrity.

A phased testing program is implemented for the RPP-WTP, with the testing schedule established by the availability of systems and their dependence on associated systems. Specific tests are implemented for each system including testing of the supporting or supported systems. Interface testing is of prime importance to the success of testing in this phased manner because the consequences of failure affects the overall schedule. System integration only occurs when each end of an interface has been adequately tested to give confidence that integration will succeed.

When systems have sufficiently demonstrated their ability to function, process operation may begin. A series of system performance demonstrations (SPD) are typically performed to commission new facilities, and the number of SPDs depends on the function of the facility and the materials handled. For the RPP-WTP, the following four levels of SPD are demonstrated:

1) Process systems using water (cold test)
2) Mechanical handling systems (cold test)
3) Facility operation using simulants (cold test)
4) Facility operation using active materials (hot test).

All SPD levels are not applied for all systems and components. For example, the first level would not be applied to the melters or vent systems.

Because the fourth-level SPD is the first time that the facility becomes radioactive, faults identified during previous testing can be corrected without any decontamination costs or radiological hazards. On successful completion of the fourth-level SPD, the facility is ready for normal operations.

The involvement of operations personnel throughout the design process and the involvement of design engineering personnel through the beginning of operations when the facility is turned over to operations are key elements in the design and testing philosophy. The development of facility control system simulators in advance of facility testing also strengthens the ability and confidence in the performance of the facility control systems and operator interfaces.

Such simulators have several purposes: they allow testing of the control systems software offline, without risk to personnel or the facility; they permit proving of the testing, commissioning, and operational procedures and documentation; and they facilitate training of operational and maintenance personnel so they may support testing. Integration of design and operating personnel during testing is important to the successful turnover of the facility for operations because it ensures a relatively smooth transition. These activities ensure that the facility is able to demonstrate operational readiness independently of the testing schedule and in advance of hot testing activities.

3.15 Training and Qualification

Training plays an important role in the safe operation of the RPP-WTP by ensuring that personnel have sufficient knowledge to safely fulfill the roles and responsibilities of their assigned jobs. Operator training for normal operation takes benefit of facility design information, results from the startup test program, operation of similar facilities, and operation of Project demonstration facilities. Training for accident conditions is based, in part, on the safety analyses performed for the RPP-WTP including the hazard analysis and accident consequence analyses.

The training objectives include the following:

1) Improving technical ability (understanding of processes)
2) Enhancing of personal skills (communication, worker-management)
3) Increasing awareness of the workplace and signs of potential hazardous situations

4) Educating personnel in the importance of acting with regard to their own safety and the safety of others
5) Establishing a safety culture that assigns safety responsibility to the individual.

A training plan, described in ISAR Section 3.4, "Training and Qualification", incorporates the above objectives. The plan notes the following requirements that constitute a thorough approach to personnel training and qualification for the RPP-WTP.

1) Recognition of the different types of training that is required. For example achievement of a necessary level of job competence, knowledge of the requirements of applicable laws and regulations pertaining to the handling of radioactive and chemical materials, specialist training for maintenance activities, and detailed knowledge of process operations.
2) Assessment of training needs. Training is most effective when matched to the needs of the individual. This can happen with two-way communication between the training section and the individual. Each person is assessed on training needs, in conjunction with their line management and training personnel. These needs vary from individual to individual and are dependent on job type.
3) Clear definition of responsibility for training. The plan outlines which functional office within the Project is responsible for training and how this responsibility for training was assigned. Personnel are encouraged to take an active interest in their own training and development and are able to discuss with their line management how their needs can best be met.
4) The establishment of learning objectives. These objectives are derived from analyses that describe the desired performance after training.
5) Training requirements evolve as the facility and its safety program evolves. As the facility and process develop from design to testing and operations, and lessons learned from other facilities become available, training information and requirements change. For example, facility operators may need training in a new type of process developed as a result of a facility modification during operations. The training program is flexible to reflect changing requirements. However, training is continuous to reflect these changing requirements and to ensure that job proficiency is maintained; it is not driven solely by changes to administrative or engineered controls.
6) Training evaluation. A feedback process is established to ensure current training needs are being met by assessing the following:
   a) The training being given is appropriate for the task and effective (i.e., individuals learn from the training)
   b) Personnel performance in the job setting
   c) Requirements for new or updated training are being met.
7) Auditability. The training program and individual development are visible. The maintenance of training log books and regular appraisal of an individuals training needs are important in demonstrating that the RPP-WTP personnel are always correctly trained in the current procedures. The training program is evaluated by oral testing, written exams, or assessment of the work product.

Training and qualification credited for public and worker safety are in accordance with the requirements of the QAM. The program for establishing the qualification requirements for RPP-WTP personnel is summarized in ISMP Section 6.1.3, "Personnel Qualification and Resources". Details on the training and qualification programs are described in ISAR Section 3.4, "Training and Qualification".

3.16 Internal Safety Oversight

Internal safety oversight for the Project involves several oversight functions to ensure safety of the public and workers and to preclude environmental degradation. These internal safety oversight functions include corporate safety assessments, management assessments, independent assessments and audits, safety committees, incident investigations, maintenance of the authorization basis, and the USQ process. In ISMP Section 5.4, "Compliance Audits", and Chapter 10.0, "Assessments", other facets of internal safety oversight are covered. Several administrative functions provide information on the adequacy of the oversight functions and also provide information used to define the scope of future internal safety oversight functions. This information includes: performance monitoring; performance indicators; lessons learned and industry experience; and feedback and trending.

The staff possess the unique skills to perform internal safety oversight. Some of the skills applied are as follows:

1) Conducting performance-based assessments that emphasize work activity in progress
2) Reporting deficient conditions to line management
3) Following up on corrective actions to prevent a recurrence of the deficiency
4) Applying performance trending to determine existence of programmatic issues and plan for future oversight areas
5) Understanding the requirements of the Price Anderson Amendments Act and 10 CFR 820, "Procedural Rules for DOE Nuclear Activities"
6) Assisting line management to establish a positive safety culture
7) Incorporating applicable lessons learned from previous RPP-WTP incidents and industry experience at other DOE sites and the commercial power industry to the project oversight program
8) Maintaining a continuing interaction with the RPP-WTP regulator on the status and direction of project oversight activities.

Internal oversight may include participation of staff external to BNI. The external members are selected based on their experience and qualifications to provide different perspectives or expertise in specific functional areas.

3.16.1 Safety Committees

The Project Safety Committee (PSC) structure provides the overview, review, and approval functions for nuclear, radiological, and process safety, occupational safety, and environmental protection matters. The RPP-WTP contractor Executive Committee addresses corporate safety policies and matters as they relate to the Project. The RPP-WTP PSC addresses RPP-WTP-specific safety policies and regulatory requirements. This two-tier structure affords open communications and sharing of relevant information between the corporate staff and the Project.

During the design and construction phase, the Executive Committee and the RPP-WTP PSC focus on nuclear, radiological, and process safety (as related to the development of the facility design and operations) and on worker safety (as related to construction activities). As the construction phase nears completion, the safety committees' focus shifts to commissioning activities and preparations by the various Project organizations to ensure the effectiveness of their nuclear and worker safety programs during operation. During operation, the committees focus on operations, management, performance of personnel, equipment, and systems, and incidence reporting. Near the end of waste processing operations, radiological control and worker safety during deactivation also are addressed.

As part of safety communication throughout the Project, workers will be invited to participate in the safety committee meetings (e.g., during regular updates on worker safety performance, review of proposed corrective actions for incidents involving worker activities). Facility operators also serve as active members on other RPP-WTP safety committees.

3.16.1.1 RPP-WTP Contractor Executive Committee

The RPP-WTP Contractor Executive Committee provides independent oversight and review of Project matters that affect nuclear, radiological, and process safety; occupational safety; and environmental protection. The membership comprises the RPP-WTP Project Manager and senior level management of the RPP-WTP Contractor corporate organization. To accomplish its objective, the Executive Committee periodically reviews areas such as:

1) Safety programs that implement RPP-WTP policy and regulatory requirements applicable to the Project
2) Recommendation of the approval to proceed with hot operations
3) The significance of new regulations applied to Project programs, procedures, and policies
4) Unusual and off-normal incident reports
5) Reports and meeting minutes issued by the PSC
6) The effectiveness of Project safety programs and associated management controls.

The Executive Committee also initiates special independent assessments or audits, as necessary, to obtain additional information concerning the effectiveness of programs or management controls at the Project.

3.16.1.2 Project Safety Committee

The PSC provides advice to the Project Manager on matters related to safety. PSC members are specified from facility management and staff. Specialists in specific fields and external subject matter experts may also be specified, as required. The members are specified from several different organizations and backgrounds to ensure that advice on safety matters is representative of an integrated evaluation of the matters under consideration.

The PSC Chairperson coordinates and facilitates the committee decision making process to achieve consensus on decisions and recommends approval by the Project Manager or designee.

The PSC reviews the management and the performance of the RPP-WTP nuclear, radiological, process, and occupational safety and environmental protection activities, including the following:

1) Results from the Safety Improvement Program
2) Identification, resolution, and implementation of recommendations and corrective actions resulting from nonconforming items or activities, incident investigations, audits and assessments, inspections and reviews, or emergency exercises
3) Unusual and off-normal incident reports, including TSR violations
4) Reports covering such topics as proposed RPP-WTP modifications, emergency exercises, and the implementation of findings from management assessments
5) Performance indicators and trends of the RPP-WTP for worker, public, and environmental safety activities
6) Results of training programs for safety-related activities
7) Operating problems
8) Effectiveness of the safety/engineering interface with respect to the incorporation of safety and environmental requirement in the design.

The PSC is also responsible for reviewing and recommending approval to the Project Manager or his designee, for safety-related documents, such as the following:

1) Proposed changes to the authorization basis
2) Positive USQ determinations prior to submittal to the regulator
3) Procedure development processes and selected facility procedures
4) Proposed Important-to-Safety design changes
5) Responses to Notices of Violations from the regulator
6) Authorization requests and other regulatory submittals
7) State of Washington permits and license applications
8) RPP-WTP pre-operational testing programs including summaries of test procedures and test results

The PSC reviews audit and assessment reports and recommends actions.

The PSC may make use of subcommittees, as appropriate, to provide oversight to specific functional areas or complete specific tasks or evaluations.

3.16.2 Safety Improvement Program

A safety improvement program is developed and implemented by the PSC. The key theme in the safety improvement program is that it is owned by all RPP-WTP personnel with the demonstrable commitment and leadership of senior RPP-WTP management.

The safety improvement program is coordinated, monitored, and implemented by the following:

1) The establishment of the PSC to oversee safety performance
2) The establishment of safety improvement groups to identify and implement improvement initiatives within their work area
3) The senior management support and demonstrated commitment to the PSC by attendance at committee meetings
4) The reviews of safety performance and implementation of safety improvement action plans about four times per year via an appropriately constituted review group established by the PSC. Representatives are selected based on the scope of the review, personnel expertise required for the review, and personnel qualifications.

3.16.3 Incident Investigations

Incident investigations involve the identification, categorization, notification, reporting, and processing of information related to incidents, emergency events, and accidents associated with the RPP-WTP. Incident reports are sent to the DOE Occurrence Reporting and Processing System. Although the incident reporting process is usually initiated with operation of a nuclear facility, the process is developed and implemented for the RPP-WTP construction and testing activities in preparation for operation.

The incident investigation and reporting procedures, and the training to these procedures, ensure that the RPP-WTP regulator, the DOE Program Office, and RPP-WTP management are kept informed on a timely basis, of events and conditions during construction, testing, and operational activities that could adversely affect quality assurance, security, environment, operations, or the health and safety of the public and workers. Incident reports are evaluated for a potential noncompliance to a nuclear safety requirement reportable by the requirements of 10 CFR 820 “Procedural Rules for DOE Nuclear Activities”.

For an incident that indicates a potential inadequacy of previous safety analyses as defined in an approved safety analysis report or that indicates a possible reduction in safety margins as defined in the TSRs, actions are taken to place or maintain the facility in a safe state and a safety evaluation is performed. The completed safety evaluation is submitted to the regulator before removing any operational restrictions initiated in response to the incident.

Additional detail on incident investigations is included in ISMP Section 5.6.7, “Investigation of Incidents” and ISAR Section 3.7, “Incident Investigations”.

3.16.4 Unreviewed Safety Questions

1) The probability of occurrence or the radiological or chemical consequences of an accident or malfunction of equipment important to safety, previously evaluated in the facility safety analyses or other related safety analysis and evaluations not yet included in the updated facility safety analysis, may be increased
2) A possibility for an accident or equipment malfunction of a different type than any evaluated previously in the facility safety analyses or other related safety analysis and evaluations not yet included in the updated facility safety analysis, may be created
3) Any margin of safety is reduced.

Proposed temporary or permanent changes to administrative and engineered controls are reviewed by qualified USQ evaluators to determine if they would involve a USQ. An activity will not be undertaken without DOE review and approval if the initiation of the activity would itself involve an unreviewed safety question. If the proposed change does involve a USQ, one of the following three options are pursued.

1) The proposed activity is abandoned.
2) The proposed activity is modified to remove the USQ.
3) The proposed activity is submitted to the regulator for review and approval prior to completion of the activity.

The following organizations have key roles in the RPP-WTP USQ process.

1) The ES&H Organization is responsible for the developing the USQ procedure, developing the training and qualification requirements for USQ evaluators, and maintaining the list of qualified evaluators.
2) The Facility Manager approves the USQ procedure and the training and qualification requirements for USQ evaluators.
3) The Configuration Management Organization is responsible for establishing and implementing the process by which proposed changes, tests, and experiments are reviewed by the USQ process.
4) The PSC approves USQ determinations prior to their submittal to the regulator.

3.16.5 Performance Monitoring

Performance monitoring is used at the RPP-WTP to verify that ES&H and other RPP-WTP programs, plans, and procedures exist; are in place; are adequate; are functioning as designed; and are in compliance with applicable regulatory or permit requirements. Performance monitoring is conducted by a RPP-WTP multidisciplinary team consisting of quality assurance, environmental protection, industrial safety, process safety, health physics, nuclear safety, and regulatory staff. Performance monitoring includes, but is not limited to, reviewing records, plans, and procedures; visually observing operations/activities; and interviewing key personnel. Findings are provided in written reports with recommendations for improvements as applicable. During design and construction, the findings are provided to the Project Manager and during pre-operational testing, operation, and deactivation, the findings are provided to the Facility Manager.

Performance monitoring is conducted to ensure high standards of performance in the following areas:

1) RPP-WTP site monitoring program
2) Health and safety program
3) Personnel training program
4) Employee concerns program
5) Hazardous material inventory and waste tracking systems
6) Facility safety requirements
7) Conduct of operations and maintenance
8) Environmental program
9) Housekeeping
10) Employee compliance to established safety and quality criteria (See ISMP Section 3.4, “Safety/Quality Culture”)
11) Quality Assurance Program.

3.16.6 Performance Indicators

Performance indicators for safety and environmental protection objectives are established for the Project. Performance is monitored on a periodic basis to determine progress of the Project in achieving these indicators. Examples of performance indicators are as follows:

1) A change in the number of lost-time accidents and recordable injuries
2) Radiological exposures of facility personnel
3) Radiation workers exceeding a specified annual exposure level
4) Operation outside the established limits for discharge and disposal of waste
5) Entry into TSR actions statements for reasons other than TSR-required surveillance

6) Violations of TSRs
7) Findings of audits and assessments
8) Unusual incidents
9) Maintenance backlog
10) Effectiveness of the maintenance program (e.g., time to repair, control room annunciators, and equipment out of service)
11) Fire impairments.

3.16.7 Lessons Learned

The lessons-learned program, established and maintained by the ES&H Organization, includes the identification, documentation, validation, and dissemination of lessons-learned information from the Project. An industry experience program that draws on lessons learned, events, deficiencies, and other similar information from other operating sites for the purpose of enhancing the safety of the facility will be established early in Part B.

This information is used in the revision of applicable procedures, development of training curricula, and in the modification of training materials. Personnel potentially affected by lessons-learned material can participate in this training process by providing feedback on information distributed and identifying information for potential inclusion in the process.

3.16.8 Feedback and Trending

As described above, incidents occurring in the RPP-WTP are used as lessons learned to feed relevant information back to appropriate RPP-WTP staff members and the training programs to assist in precluding recurrence. The lessons learned are applied in a broad manner within the RPP-WTP, rather than focused only on the specific administrative or engineered control involved in the incident. Significant lessons learned are provided to the Project Manager during design and construction and to the Facility Manager during operation and deactivation.

Trending within various performance areas, such as operations, training, and maintenance, is used to verify that continuous improvement is being achieved in the Project. In the event that repeat events, findings, or other deficiencies are indicated, follow-up actions are initiated to identify additional corrective actions needed to preclude further recurrence. These additional corrective actions are tracked to completion and their adequacy to correct adverse trends is verified. Adverse trends are also evaluated to determine the existence of a programmatic failure of nuclear safety requirements subject to reporting in accordance with 10 CFR 820, “Procedural Rules for DOE Nuclear Activities”.

4.0 Standards-Based Management

This chapter summarizes the development of the safety management processes and describes how activities and documentation are tailored to the identified hazards and hazardous situations.

4.1 Safety Management Processes

The Project safety management processes are developed through the safety approach as described in Integrated Safety Management Plan (ISMP) Chapter 1.0, "Project Safety Approach", and shown in Figure 1-1.

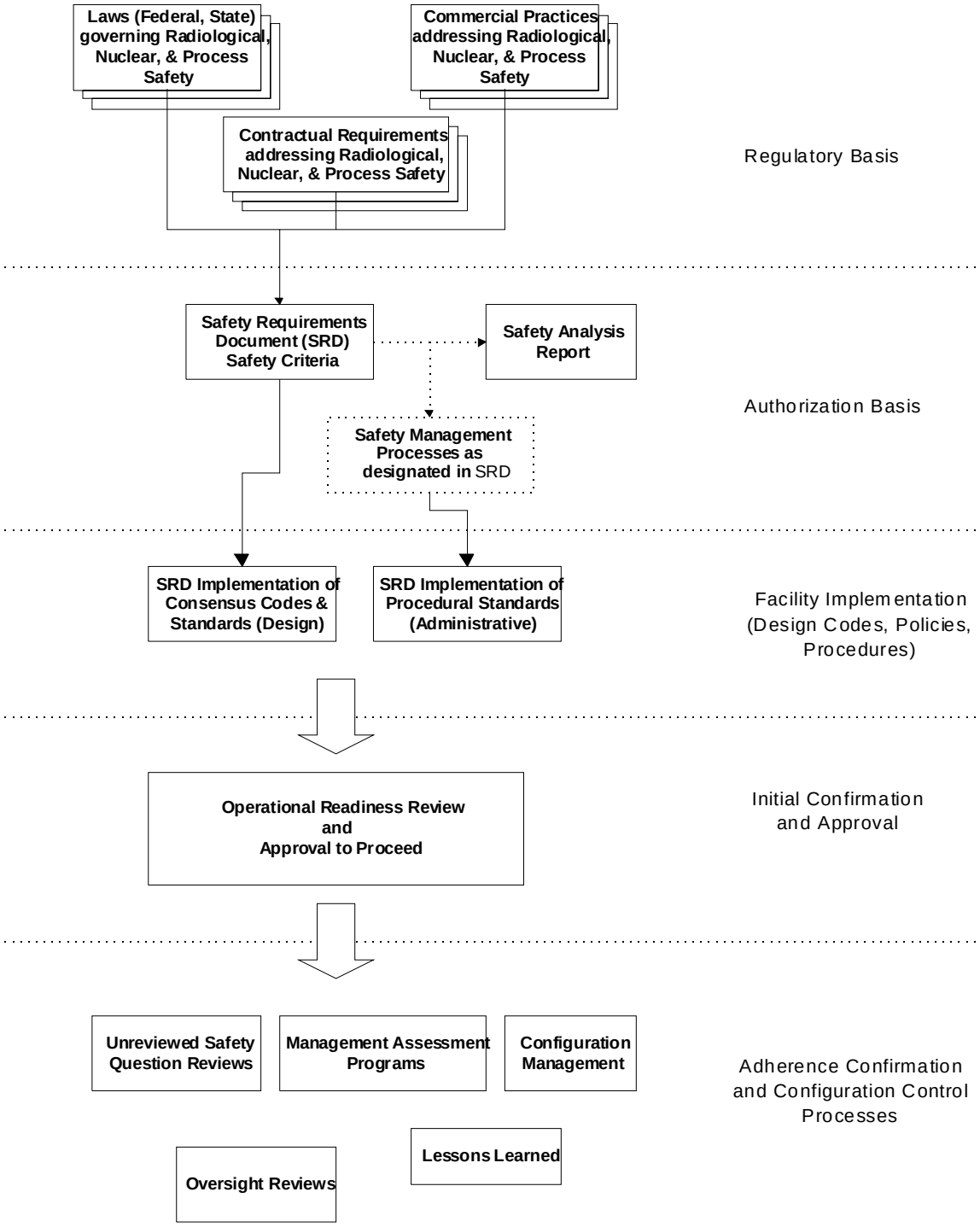
4.1.1 Development of Safety Management Processes

The safety management processes governing radiological, nuclear, and process safety are identified and developed as a part of the Safety Requirements Document (SRD) as shown in Figure 4-1. The SRD development process is discussed in the *Safety Requirements Document* (BNI 2001b).

Development of the Standards-Based Safety Management Programs through the safety approach as part of the SRD development has the following benefits:

1) Continually integrates hazards identification, SRD development, design development, and accident analysis during all phases of the facility life cycle through deactivation
2) Documents the safety management process drivers within the SRD. It also ensures the processes are established in accordance with the applicable regulatory, commercial, and U.S. Department of Energy (DOE) standards and the DOE Top-Level Safety Principles as appropriate to control hazards and hazardous situations associated with the RPP-WTP.
3) Adopts the use of "best industry practices" that include process safety management, a rigorous design process based on a set of credible accidents and a defense-in-depth philosophy, and verification of the level of facility safety through safety analysis and validation of requirements implementation
4) Documents that the facility design meets the required Safety Criteria and documents how and why the engineered and administrative controls credited for public and worker safety were identified. In Part B, when policies and procedures are written to implement the administrative controls, these policies and procedures will be identified in the SRD.

Figure 4-1 Safety Management Processes



4.1.2 Identification of Safety Management Program Drivers

Through the SRD development process, the following safety management programs are identified that:

1) Directly implement regulatory requirements for programs that provide protection of the public and workers from radiological, nuclear, and process hazards (e.g., Risk Management Plan, Radiation Protection Program)
2) Are credited for providing adequate protection to the worker or public (e.g., Emergency Preparedness Program)
3) Place controls on the design, operations, or maintenance of structures, systems, and components (SSC) that are credited for providing adequate protection to the worker or public (e.g., Configuration Management, Conduct of Operations, Quality Assurance, Maintenance).

The following sections outline the programs and identify the SRD sections governing the development of the safety management programs for the RPP-WTP.

4.1.2.1 Nuclear and Process Safety Program

The Nuclear and Process Safety Program addresses the Project integrated approach to nuclear and process safety. It identifies the methodology and Safety Criteria for assessing that the risks posed by the operation of the RPP-WTP are within the overall safety objectives and commitments. The Nuclear and Process Safety Program addresses the following attributes: prevention of accidents, accident and operations risk goals, defense-in-depth, hazards analysis; accident analysis; and criticality. These programs are defined in the SRD Volume II, Chapters 1.0 “Radiological, Nuclear, and Process Safety Objectives”, and 3.0 “Nuclear and Process Safety”.

4.1.2.2 Engineering and Design Programs

The Engineering and Design Program provides the principles governing the design of and identifying design expectations for those SSCs credited for protection of the public and workers. The engineering and design programs include topics such as the configuration management of facility and system design, design practices and procedures for SSCs credited for protection of public and workers, and the facility’s fire protection program. These programs are defined in the SRD Volume II, Chapter 4.0, “Engineering and Design”.

4.1.2.3 Radiation Protection Program

The Radiation Protection Program addresses the protection of the public and workers (when accessing controlled areas) in accordance with 10 CFR 835, *Occupational Radiation Protection*. The Environmental Radiation Protection Program addresses the protection of the public and the environment from normal activities that may release radiological effluents. These programs are defined in the SRD Volume II, Chapter 5.0, “Radiation Protection”.

4.1.2.4 Commissioning Program

The Commissioning Program addresses those requirements applicable to startup of the RPP-WTP and to other operational processes. Commissioning program topics include equipment and system acceptance, pre-operational testing, and validation of operational procedures. This program is defined in the SRD Volume II, Chapter 6.0, "Startup".

4.1.2.5 Management and Operations Program

The safety management programs covered under the umbrella of Management and Operations Programs address programs that establish principles governing the conduct of day-to-day operations which are important in maintaining a safe facility. Included in these programs are the following topics:

1) Management and organization
2) Training, qualification, and procedures
3) Commitment tracking
4) Quality assurance
5) Management assessments
6) Lessons learned
7) Unreviewed safety questions
8) Conduct of operations
9) Conduct of maintenance
10) Employee feedback
11) Incident investigation and reporting
12) Emergency preparedness.

These programs are defined in the SRD Volume II, Chapter 7.0, "Management and Operations".

4.1.2.6 Deactivation and Decommissioning Program

The Deactivation and Decommissioning Program addresses the commitment for deactivation and the design and operational considerations for decommissioning. As the facility approaches deactivation, requirements that provide adequate safety for the activities and inherent hazards of the deactivation process are added to the SRD. This program is defined in the SRD Volume II, Chapter 8.0, "Deactivation and Decommissioning".

4.1.3 Development of Safety Management Programs

The majority of policies, procedures, and instructions fully defining the safety management programs will be developed prior to commissioning of the RPP-WTP. Procedural development will be based on accepted industry practices for ensuring safety through adequate training, conduct of operations, and engineering and design programs. Procedures will be developed internally by the responsible Project organizations.

When developed, these policies, procedures, and instructions (administrative standards) are linked to the driver requirements (Safety Criteria) contained in the SRD. This linking of implementing standards to Safety Criteria ensures that the safety management programs, as defined in the SRD, are fully implemented.

In addition, the consensus codes and standards used in the design of SSCs are linked to SRD Safety Criteria. This link is implemented through Project documents like the Design Input Memorandum. Design guides provide additional detailed project-specific guidance and specifications for topical areas (e.g., radiation protection, human factors, natural phenomena design) and individual systems and areas of the facility (e.g., process ventilation system, melter cell walls, process offgas). All of these links are controlled to ensure that configuration management of the linkage to the SRD is maintained at all times.

Figure 4-2 shows the implementation of the SRD through the design process using these guidance documents.

A key feature of the SRD process is the ability to effect changes to the SRD (when such a change is appropriate). As shown in Figure 4-3, these SRD changes may arise as a result of design evolution or may be identified through the hazard evaluation process. Changes of the first type occur when a proposed design position offers benefits (cost, safety, reliability) but is not fully in compliance with the SRD as written. Changes of the second type may result from newly identified accidents or off normal conditions (indicated by dashed boxes). In either case, all activities are documented, and no change to the SRD is initiated without a formal review for compliance with the standards and requirements on which the SRD is based.

4.1.4 Compliance to and Maintenance of Safety Management Programs

The SRD applies to BNI project contractors.

Compliance to a standard which is included in Volume II of the SRD means that all mandatory statements (shall/will/must) applicable to nuclear, radiological, or process safety are implemented or deviations justified and approved by the DOE. Compliance with non-mandatory statements (should/may) are not required; but are reviewed and considered for each standard on an individual basis. This review is documented. Compliance to statements not applicable to nuclear, radiological, or process safety may in many cases be required to ensure compliance to regulations outside the scope of the DOE review (e.g., environmental protection); however, if no other regulatory entity requires compliance via the standard, compliance is not required to be reviewed on an individual basis.

Safety Management Programs will be scrutinized and revised, as appropriate, as a part of the biannual SRD revision process. This revision process incorporates updated hazards and design information as well as potential new regulatory requirements. This biannual review will ensure that the safety management programs are appropriately tailored to the hazards posed by the facility and comply with laws, regulations, and contractual commitments.

In addition, linking the implementing procedures to the SRD Safety Criteria provide a means of ensuring that revisions to these procedures are reviewed to confirm the safety management programs remain implemented.

Figure 4-2 SRD Link to Design

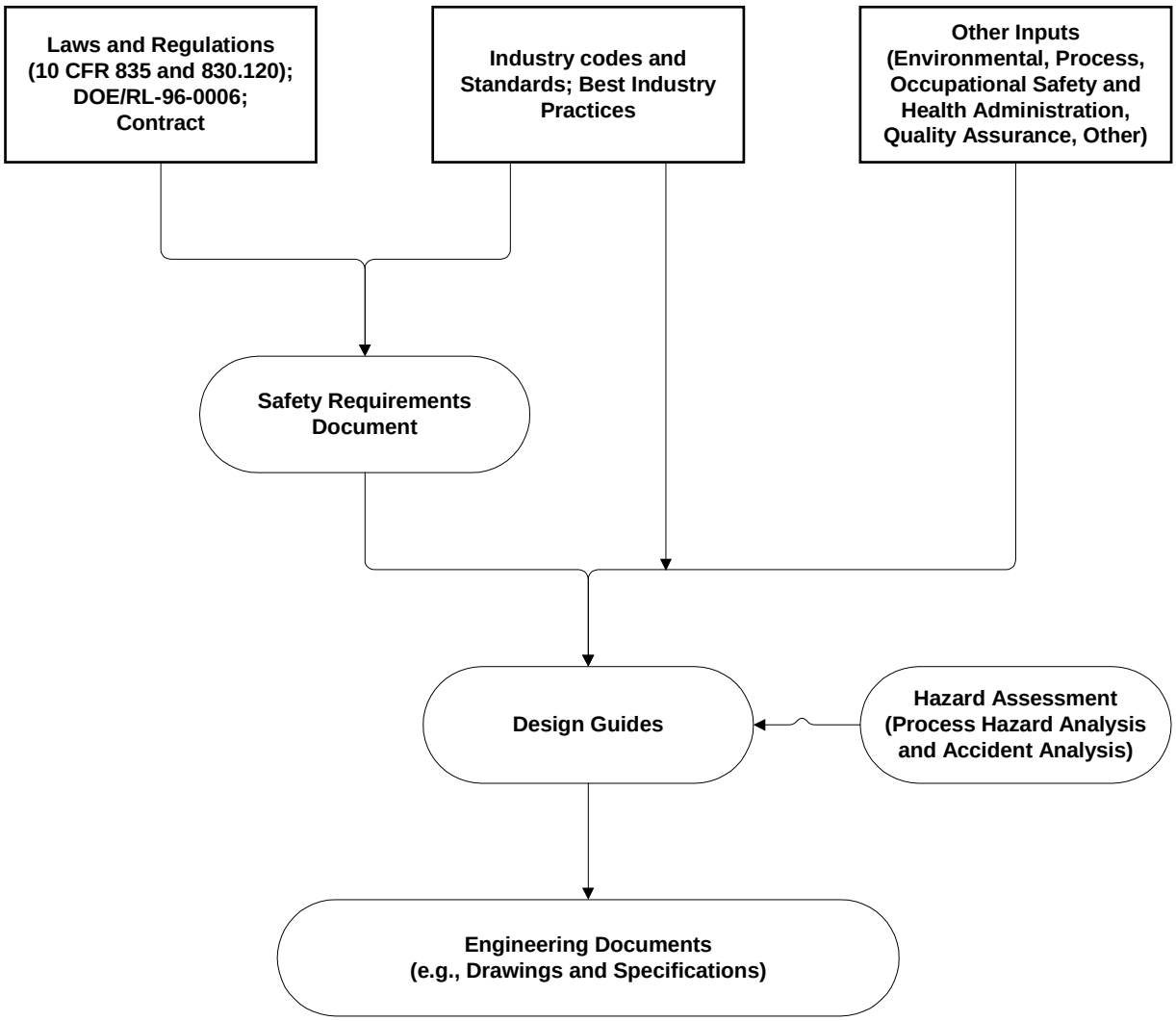
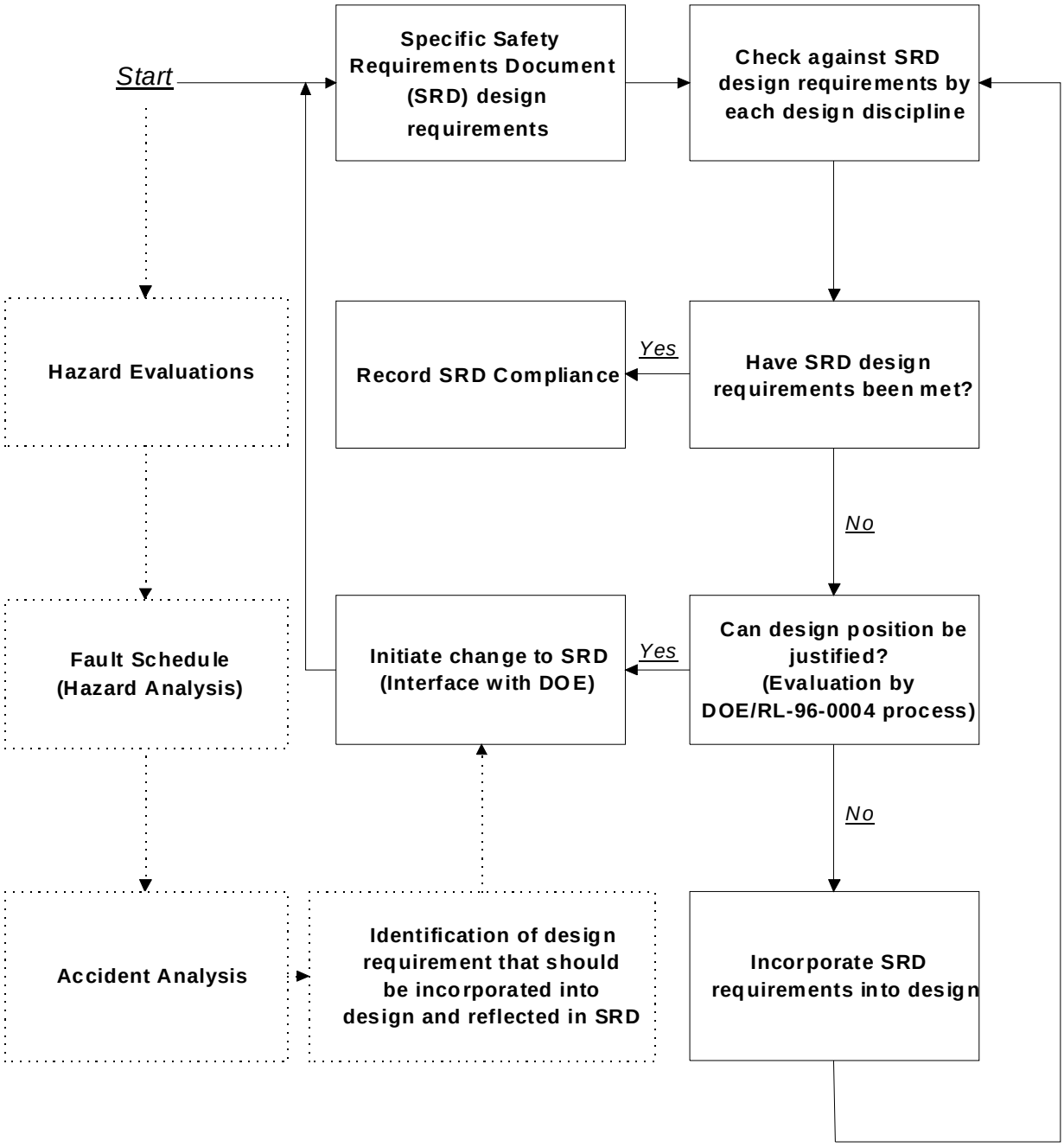


Figure 4-3 SRD Change Process



Proposed changes to the SRD are evaluated for impact on safety compliance with regulations and the authorization basis (including hazard and accident analysis) and then are reviewed and approved commensurate with the process applied to the original configuration, including regulatory approval before implementing changes that could be considered as decreasing the prescribed level of safety. The essential elements of DOE/RL-96-0004 *Process for Establishing a Set of Radiological, Nuclear, and Process Safety Standards and Requirements for TWRS Privatization*, as addressed in the original development of the SRD, are maintained, including the use of subject matter experts and the use of an equivalent level or review and approval of the proposed change. Changes are made by an established configuration management process.

4.2 Tailoring Safety Management Processes

The aspects of the RPP-WTP design that are critical to safety are identified through Process Hazard Analysis (PHA). This process is a systematic team-based review of the facility and process designs that identifies hazards and hazardous situations to a level of detail commensurate with the available design detail. Major hazards and hazardous situations are identified as the level of design detail increases and additional PHAs are performed in Part B. Having generated the list of hazards and hazardous situations, this list is subject to a further systematic team-based review where a binning process takes place.

Hazardous situations are assessed and binned according to a qualitative, and experience, and team-based judgement of frequency and consequence (severity). This binning process receives benefit from the BNI team's experience with safety analysis and operation. Frequency bands are defined and labeled as normal, anticipated, unlikely, and extremely unlikely. Consequences range from negligible through minor to serious and major. The binning process is essentially risk based with categories of hazard defined according to a frequency/consequence matrix. This approach is consistent with the American Institute of Chemical Engineers (AIChE) guidelines on hazard evaluation (AIChE 1992). The binning process assigns hazards as acceptable, acceptable with controls, undesirable, or unacceptable.

In this way, a hierarchy of hazards and hazardous situations is identified. This hierarchy is reviewed and, where possible, the design is modified to eliminate hazards. Where this cannot be done, protection systems are identified that would prevent, protect against, or mitigate the hazardous situation. Protection systems would be a combination of engineered features (e.g., alarms, trips, and interlocks) and administrative controls (i.e., operator actions).

The application of protection systems is tailored to the hazard severity. For example, high-frequency hazards with severe consequences have protection systems involving diverse engineered features and training and procedures requirements as discussed in Section 4.2.2, "Training and Procedures". Less significant hazards would require fewer protection systems that may lean heavily on administrative procedures, the importance of which will have been stressed through adequate worker training. This ensures the appropriate level of safety is provided.

4.2.1 Engineered Features

Engineered features include SSCs that provide for public and worker safety. The design, fabrication, construction, installation, testing, operation, maintenance, and quality assurance requirements for engineered features are tailored by the classification process discussed in ISMP Section 1.3.10, "Classification of Structures, Systems, and Components".

4.2.2 Training and Procedures

Operator training and procedures ensure that the facility is operated safely. The development of the training and procedures during facility design and commissioning takes account of the differing safety requirements. Procedures support the safe operation of the facility in varying ways. A hierarchy of procedures is developed that reflects the level of safety importance. Factors that determine the level of safety importance for training and procedures include support they provide for maintaining compliance to the Technical Safety Requirements (TSR) and maintenance of Safety Design Class and Safety Design Significant SSCs. Those at the highest level are subject to increased rigor with respect to their development and implementation. Increased rigor means independent review and endorsement by suitably qualified and experienced personnel or safety committees. All procedures that have an impact on the safe operation of the facility are developed and implemented with a suitable degree of rigor commensurate with their safety importance.

Operator training and qualification requirements are tailored to operator requirements. Facility area operators are trained and qualified in their specific areas of operation, radiological and chemical hazards, and necessary emergency requirements (facility recovery and facility and site evacuation). Facility supervisors and operators with increased responsibility receive additional training (e.g., in specific operations, resetting of facility items required for safety, and emergency response). Training ensures that operators receive the necessary knowledge and experience to conduct operations with due regard for safety. Training of maintenance and technical personnel is tailored to the involvement of these personnel in the establishment and maintenance of administrative and engineered controls. More in-depth and frequent training is provided for those individuals involved with Safety Design Class and Safety Design Significant engineered features.

4.2.3 Tailoring of Safety-Related Documentation

The following sections describe how the safety analysis reports (SAR), Integrated Safety Management Plan (ISMP), Safety Requirements Document (SRD), TSRs, and emergency plan are tailored to the phases, hazards and hazardous situations of the RPP-WTP.

4.2.3.1 Safety Analysis Reports. The format and content of the Preliminary Safety Analysis Report (PSAR) and Final Safety Analysis Report (FSAR) are in accordance with the guidance provided in U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 3.52, *Standard Format and Content for the Health and Safety Sections of License Applications for Fuel Cycle Facilities*, draft (NRC 1995a). To facilitate the review of the SARs by the regulator, the SAR content also gives consideration to the review guidance provided in *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility*, NUREG-1520, draft (NRC 1995b).

The format and content of the SARs are tailored to the nature of the RPP-WTP relative to the hazards and hazardous situations identified by the PHA. Table 4-1 lists the planned deviations from the format and content guidance of Regulatory Guide 3.52 in this regard. These deviations include both format changes in terms of added SAR sections and content changes for several of the SAR sections.

Table 4-1 Deviations from the Safety Analysis Report Content Guidance of Regulatory Guide 3.52 [1] (Sheet 1)

Chapters	Addition or Subtraction	Basis
1.3 Site Description	Regulatory Guide (RG 3.52) suggests that Section 1.3 summarize information used in preparing the Environmental Report. Specific information is referenced, but not duplicated in the safety analysis report (SAR).	The Environmental Report provides this information.
1.3.2 Demography and Land Use	The population distribution as a function of distance and direction is not to be provided. The distances to nearby population centers are provided.	There are no residences on the Hanford Site and the nearby population is low.
3.3 Quality Assurance	Section 3.3.4, "Quality Program Description", addresses the 10 criteria of 10 CFR 830.120, "Quality Assurance Requirements" in lieu of the 18 criteria listed in RG 3.52.	By contract compliance to the 10 CFR 800 series of nuclear safety requirements is required. This includes compliance to 10 CFR 830.120, "Quality Assurance Requirements". The differences in the criteria to be addressed are not significant because the quality assurance programs are based on consensus standards.
3.5 Human Factors	RG 3.52 states that a formal human factors program is not required if the facility has no requirement for safety-class actions. Human factors are considered in the Preliminary Safety Analysis Report (PSAR) independent of whether or not human actions are required for protection of the public or workers.	The requirements of DOE/RL-96-0006 (DOE-RL 1996a), Section 4.2.6, "Human Factors", extend beyond consideration of human factors as related to actions taken to protect the public. Final Safety Analysis Report (FSAR) Section 3.5 documents how compliance to contract Section 4.2.6 is achieved.
3.10 Testing Program and Preoperational Safety Review	This section is added to address the initial and commissioning testing programs.	Addition of this section facilitates documentation of compliance to DOE/RL-96-0006 (DOE-RL 1996b), Section 4.2.8, "Pre-Operational Testing", and Section 5.2.6, "Pre-Startup Safety Review", and DOE/RL-96-0003 (DOE-RL 1996a), Section 4.3.2, "Contractor Input", item 13.
3.11 Operational Practices	This section is to added to address such conduct of operations considerations as shift routine and turnover, control area activities, communications, control of on-shift training, control of equipment and system status, lockout and tagout, independent verification of equipment status, logkeeping, and operational aids postings.	These items are discussed to address what is normally considered conduct of operations.

Table 4-1 Deviations from the Safety Analysis Report Content Guidance of Regulatory Guide 3.52 [1] (Sheet 2)

Chapters	Addition or Subtraction	Basis
4.7 Results of the Integrated Safety Assessment	The results for unmitigated accidents are compared to the radiological standards discussed in Integrated Safety Management Plan (ISMP) Section 1.2, "Detailed Description of the Safety Approach" rather than to 10 CFR 20, "Standards for Protection Against Radiation". A full assessment of the hazardous situations that might present themselves during facility operation is provided. This includes estimates of radiological and chemical releases for this range of events. Additional details are provided on the methodology used for consequence analysis, bounding conditions, input assumptions, and accident sequences.	The standards provided in RG 3.52 were derived from 10 CFR 20, "Standards for Protection Against Radiation", which is applicable to normal operation. The nature of the accidents for the RPP-WTP requires more discussion of consequence analysis than that required of fuel fabrication facilities.
4.8 Controls for Prevention and Mitigation of Accidents	This section identifies the specific safeguards selected for protection of the facility workers, as well as safeguards selected for protection of the public and collocated workers.	The nature of the accidents for the RPP-WTP requires more discussion of consequence analysis than that required for fuel fabrication facilities.
5.0 Radiation Safety	Chapter 5.0 provides the upper-level statutory standards and program policies that ensure the radiological safety of employees, visitors, and onsite members of the public. Deviations from RG 3.52 are as follows: 1) As an U.S. Nuclear Regulatory Commission (NRC) document, RG 3.52 references and specifies applicable portions of 10 CFR 20. Because 10 CFR 835 is the radiation safety regulation for the RPP-WTP, the focus of this section is on 10 CFR 835. 2) The implementation-level standards and guidance documents referenced in RG 3.52 is being incorporated into the Radiation Protection Plan (RPP).	Compliance with 10 CFR 835 is a requirement of the contract. The RPP required by 10 CFR 835 is required to include some of the information required of RG 3.52. There is no need to present this information in two documents.
5.1 As Low As Reasonably Achievable (ALARA) Policy and Program	RG 3.52 states that Regulatory Guide 8.10, Revision 1R (*Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Reasonably Achievable)* should be used in the development of the ALARA program. DOE guidance such as DOE G 441.1-2, *Occupational ALARA Program Guide* will also be used to develop the RPP-WTP ALARA program for normal operation.	DOE practices have proven to be successful for facilities similar to the RPP-WTP.
5.3 Radiological Safety Standards	Section 5.3 is added to provide the radiation standards by which the program operates. The standards specifically identify regulatory exposure standards, administrative exposure control levels, and other key standards of the radiation protection program.	The contract requires compliance to the 10 CFR 800 series of nuclear safety requirements. This includes compliance to 10 CFR 835, "Occupational Radiation Protection". Section 5.3 documents the compliance to the exposure standards of those regulations that have been promulgated.

Table 4-1 Deviations from the Safety Analysis Report Content Guidance of Regulatory Guide 3.52 [1] (Sheet 3)

Chapters	Addition or Subtraction	Basis
5.8 External Exposure (renumbered 5.9 from RG 3.52)	By RG 3.52, the applicant is expected to participated in the National Voluntary Laboratory Accreditation Program (NVLAP) external dosimetry. Section 5.8 allows for participation in either the NVLAP or U.S. Department of Energy (DOE) Laboratory Accreditation Program (DOELAP) accreditation programs.	The option of participating in either the NVLAP or the DOELAP provides maximum flexibility and equivalent dosimetry program quality
5.14 Radioactive Waste Management	RG 3.52 does not require a discussion of waste management systems.	Section 5.14 is added to the SARs as the Process Hazards Analysis (PHA) completed for the RPP-WTP have identified hazards and hazardous situations with the waste management features of the facility. It is a requirement of DOE/RL-96-0003 (DOE-RL 1996a), Section 4.1.2, "Contractor Input", that deliverables be tailored to the nature and level of hazards associated with its waste processing activities.
Appendix 5A Radiation Protection Program Outline	This appendix is added to address compliance to 10 CFR 835.	The contract requires compliance to the 10 CFR 800 series of nuclear safety requirements. This includes compliance to 10 CFR 835, "Occupational Radiation Protection".
Appendix 5B Environmental Radiation Protection Program Outline	This appendix is added to address compliance to the requirements of the Environmental Protection Agency (EPA) and Washington State laws and regulations.	The contract requires submittal of an outline for the environmental radiological protection plan.
Chapter 6.0 Nuclear Criticality Safety	The methodology for criticality analyses is provided in the SARs to the extent the need to perform criticality calculation is found to be appropriate. The RPP-WTP SARs provide fewer details and commitments compared to fuel fabrication facilities relative to: 1) Nuclear criticality safety organization (Section 6.2.1) 2) Criticality training (Section 6.2.5) 3) Specific maintenance and quality assurance provisions for criticality prevention (Sections 6.2.3 and 6.2.4) 4) Audits and inspection (Section 6.2.6)	RG 3.52 focuses heavily on accidental criticality which is a more significant concern for fuel fabrication facilities which have a much higher inventory and concentrations of fissile material than the RPP-WTP. See ISMP Section 3.8, "Criticality Safety", for additional information.

Table 4-1 Deviations from the Safety Analysis Report Content Guidance of Regulatory Guide 3.52 [1] (Sheet 4)

Chapters	Addition or Subtraction	Basis
7.4 "Hazardous Waste Management"	Section 7.4 of the RPP-WTP SARs address all chemical inventories that are identified by the PHA as representing a significant hazard.	By Section 4.2.2, "Contractor Input", of DOE/RL-96-0003 (DOE-RL 1996a), the Initial Safety Analysis Report (ISAR) is to address process safety as well as radiological and nuclear safety. The need to address all aspects of chemical safety is also an NRC requirement of RG 3.52, Section 7.4, and NUREG-1513, "Integrated Safety Analysis Guidance Document", (draft) (NRC 1994). The NUREG-1513 definition of "integrated" provided in Section 2.1, "Definition", makes reference to chemical safety. Specific guidance for chemical safety is provided in Section 2.6.2, "Process Safety Information", of the NUREG-1513.
10.0 Environmental Protection	This chapter references the Environmental Report	Protection of the environment is addressed in a separate document.
11.0 Deactivation and Decommissioning	This chapter addresses design and operational provisions considered to facilitate deactivation and decommissioning. It does not address the financial considerations for decommissioning.	The scope of the contract (DOE-ORP 2000) of Part B is limited to design support for deactivation.

1. Standard Format and Content for the Health and Safety Sections of License Applications for Fuel Cycle Facilities, Regulatory Guide 3.52, Revision 2, draft, U.S. Nuclear Regulatory Commission, Washington D.C. (NRC 1995a).

For example, the results of criticality calculations summarized in the ISMP Section 3.8, "Criticality Safety", indicated that criticality is not a significant hazard for the RPP-WTP. Therefore, the content of SAR Chapter 6.0, "Nuclear Criticality Safety", is reduced. However, because accident consequence analyses are important to the Project safety approach, the content of Initial Safety Analysis Report (ISAR) Section 4.7, "Results of the Integrated Safety Assessment", will be strengthened, in the PSAR, in terms of the discussion of the methodologies used, boundary conditions, input assumptions, and the descriptions of the accident sequences.

The content of the PSAR and FSAR is tailored to the purpose of these two documents. The PSAR supports the request for the construction authorization by documenting the safety criteria, the principal design and construction requirements, and the initial safety analysis. The FSAR documents application of these criteria to the completed RPP-WTP, documents the final safety analysis, and establishes the facility can be operated safely. The PSAR places greater emphasis on design criteria and construction practices than conduct of operations. The FSAR places emphasis on conduct of operations. Table 4-2 lists the planned differences between the content of the PSAR and FSAR to achieve this focus.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 1)

Title	PSAR	FSAR
1.0 General Information		
1.1.1 Facility Description	A description of the facility design is provided in sufficient detail to demonstrate the facility design and construction requirements of the Safety Requirements Document (SRD). The details are also sufficient to support an understanding of the safety analysis provided in Section 4.2, "Facility Description".	This section updates the general description of the facility design.
1.1.2 Process Description	This section describes the process design in sufficient detail to demonstrate the system and component design and fabrication requirements of the SRD are satisfied. Details on the process design sufficient to support an understanding of the safety analysis are provided in Section 4.3, "Process Description".	This section updates the general description of the process design.
1.2 Institutional Information	This section provides the information required by RG 3.52, draft (NRC 1995a).	This section updates any changes in the institutional information provided in the Preliminary Safety Analysis Report (PSAR).
1.3 Site Description	A description of the site land use, meteorology, hydrology, geology, and seismology is provided.	This section addresses any existing or planned changes in land use from that provided in the PSAR. The Final Safety Analysis Report (FSAR) provides any new meteorology, hydrology, geology, and seismology data made available. However, the level of detail provided for these subject areas is not significantly different between the two SARs. The FSAR summarizes data obtained during the Facility excavation that confirms the adequacy of design. This includes the results of field and laboratory investigation of soil properties.
2.1 Organization and Administration	The Project organizational charts with a focus on the design and construction management organizations are provided. An organization chart for the operational phase is also presented. More definitive information on the roles, responsibilities, and interfaces for project management, engineering, construction management, inspections, procurement, quality assurance, records management, and nuclear safety functions is included. Section 2.1 also provides the criteria to determine minimum staffing requirements. A summary of procedures to be developed to implement the regulatory requirements addressed in this section is presented.	The section contains an update to the organizational structure of Project with a focus on operational and operational support organizations. This section also includes: 1) Title of each position that is important to public and worker safety and reporting relationship 2) Description defining qualifications, responsibilities and authorities for each position related to safety 3) Organizational charts of the line organization and safety organization 4) Title of the individual delegated overall responsibility for the safety programs who has the authority to shut down operations if they appear to be unsafe, including independence of this authority from operational constraints 5) Lines of responsibility and authority for safety 6) Lines of communication and interfaces between organizations inside the facility 7) Availability of personnel within the safety organization to carry out the assigned function. Specific information on procedure development and minimum staffing requirements is provided.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 2)

Title	PSAR	FSAR
2.2 Safety Committees	Information on responsibilities, authorities, and proposed charters of safety committees, and oversight groups is provided.	This section updates information on safety committees, and oversight groups that are established following issuance of the PSAR and addresses any new safety committees that have been established.
3.1 Configuration Management	This section contains specific information on 1) Content and reference to procedures used to maintain effective configuration management of the RPP-WTP 2) Scope of identified systems, structures, and components (SSCs) and their relationship to the contents of Chapter 4.0, "Integrated Safety Analysis" 3) Description of the design information package contents to be provided to the safety analysts 4) Change control system specifics, including identification, technical and management reviews, documentation, and implementation 5) Specific physical configuration assessment, and periodic equipment performance monitoring 6) Design, installation, and testing of facility modifications 7) Revision of operating, test, calibration, surveillance, and maintenance procedures and drawings 8) Selection and control of replacement parts 9) Description of how the RPP-WTP design requirements and design basis were established and documented. A summary of procedures developed to implement the regulatory requirements addressed in this Section 3.1 is presented. This section also includes a draft of the unreviewed safety question process.	Specific information on the content of procedures and training developed is provided. The final unreviewed safety question process is provided.
3.2 Maintenance	A list of Safety Design Class and Safety Design Significant SSCs is provided. The maintenance implementation plan is described to such a level that maintenance philosophy and approach are evident.	The FSAR may modify the list of SSCs actions to be addressed based on safety analysis of the final design. Specific information on procedures and training developed to implement the requirements of Section 3.2 is provided. In addition, the elements of the finalized maintenance implementation plan is described. Also discussed is the application of information obtained from demonstration testing and commissioning programs to the maintenance program (the latter by FSAR amendment after initial submittal.)

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 3)

Title	PSAR	FSAR
3.3 Quality Assurance	Information related to the roles, responsibilities, and interfaces for project management, engineering, construction management, inspections, procurement, quality assurance, records management, and nuclear and process safety functions is provided. Included is the organizational structures of the quality assurance organization. The PSAR describes the quality assurance requirements of SSCs. Requirements for procedures to implement the regulatory requirements is presented.	For the FSAR, this section focus on the quality assurance program for the operating RPP-WTP. Specific information on procedures and training developed to implement the requirements of Section 3.3 is provided.
3.4 Training and Qualification	A description of the performance-based training program for operational and support personnel, including a detailed description of the training development process, is provided. The administrative process, to be applied to training activities is described to a level such that the elements of the program and management's commitment to training is evident.	Details on the training and qualification program are provided. Also discussed is the application of information obtained from demonstration testing and commissioning programs (the latter by FSAR amendment after initial submittal.)
3.5 Human Factors	This section documents the criteria by which human factors are considered in the facility design and operation.	This section states how human error in facility operations was taken into account in the design by facilitating correct decisions by operators and inhibiting wrong decisions. Consideration given in the design to detecting and correcting or compensating for errors is discussed.
3.6 Audits and Assessments	Information on the performance of audits and assessments is incorporated into this section.	This section is focused on audits and assessments performed during RPP-WTP operation. Specific information on procedures and training developed to implement the requirements of this section is provided.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 4)

Title	PSAR	FSAR
3.7 Incident Investigation	This section includes the following: 1) Provisions for establishing investigating teams 2) Functions, responsibilities, and scope of authority of investigating teams 3) Qualifications of internal and/or external investigators on investigating teams 4) A description of the procedures to ensure prompt investigation of an incident 5) Policy directives that the investigative process and the investigating team be independent of line management and that participants be assured of no retribution from participating in investigations 6) The approach proposed to determine the root cause(s) of incidents to ensure that the process is reasonable, systematic, and structured 7) Methods to ensure that corrective actions to resolve findings from incident investigations are tracked to completion 8) Identification and application of lessons learned 9) Specific reporting criteria for incident reporting during the construction phase. A summary of procedures developed to implement the regulatory requirements addressed in Section 3.7 is presented.	Specific information on procedures and training developed to implement the requirements is provided. Included are specific reporting criteria for incident reporting during the operations phase.
3.8 Records Management	This section contains the organization structure and a description of the records management system, including authorities, responsibilities, and qualifications of personnel managing Environmental Safety and Health (ES&H) records. A summary of procedures developed to implement the regulatory requirements contained in Section 3.8 is presented.	Specific information on procedures and training developed to implement the requirements is provided.
3.9 Procedures	A description of the administrative controls to ensure that work is performed in accordance with established technical standards and using approved instructions and procedures is provided.	This section describes the detailed processes of selecting activities requiring operating, emergency, and support procedures; preparing procedures; verifying and validating procedures; and reviewing and approving procedures. In addition, the program to administratively control procedures and their use is described in detail.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 5)

Title	PSAR	FSAR
3.10 Testing Program and Preoperational Safety Review	This section describes the analysis used to identify and define pre-operational and commissioning tests and describes tests required to ensure compliance to safety specifications. The testing program and controls are described to a level such that the testing philosophy and approach are evident. The prestart safety review approach is described to a level such that the areas to be evaluated and the evaluation approach are evident.	This section may modify the list of required safety improvement program and commissioning tests based on safety analysis of the final design. In addition, the administrative and program controls applicable to the test program are described in full.
3.11 Operational Practices	A description is provided of operational practices influenced by design details, (i.e., communications systems, operational hazards associated with systems and hardware, and control area arrangements).	A description is provided of the operational practices influenced by the final design. In addition, final descriptions are provided on controls and administration of operational practices.
4.0 Integrated Safety Analysis	The methodology for hazards identification and accident analyses is described. The accident consequence analyses include margins in assumptions, boundary conditions, modeling and comparisons to acceptance criteria, as appropriate, to account for uncertainties in the design and plans for operation. Section 4.7 addresses the relationship of these uncertainties to the need to provide sufficient information in the construction authorization package to allow for issuance of the construction authorization.	Assumptions used in the PSAR to account for uncertainties in the design and plans for operations are removed from the FSAR analysis to the extent that these uncertainties have been resolved.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 6)

Title	PSAR	FSAR
4.2 Facility Description	In addition to providing a general description of the facility, this section discusses the basic civil/structural criteria to be applied to the design. For those structures classified as Safety Design Class, this includes the following: 1) Design codes, standards, and specifications 2) Loading criteria and load combinations 3) Design and analysis methodology 4) Structural acceptance criteria 5) Criteria for identifying testing and in service inspection requirements 6) Material specifications 7) Special construction features. This section also discusses 1) Assumed soil properties 2) Excavation, backfill, and recompaction criteria 3) Assumed bearing capacity of the soil and the safety factor applied to this capacity 4) Expected static and dynamic building total and differential settlements. Less detail is provided for Safety Design Significant structures. Section 4.2 gives specific attention to those structures classified in Section 4.8 as Safety Design Class. Structures located away from the buildings containing significant hazards and that have no relationship to nuclear or process safety are briefly described (e.g., structural design, and the contents and functions of the building) and identified on a plot plan.	The FSAR updates the facility description and basic civil/structural criteria provided in the PSAR. It follows with discussions of the results of the application of these criteria to specific features of the facility. Examples are as follows: 1) The confirmation of soil properties obtained during excavation 2) A table providing the building total and differential settlement data obtained 3) Derived soil damping values 4) The results of the soil/structure analysis 5) Developed floor response spectra and time histories 6) A list of moderate and high energy systems 7) A list of specific missile and jet impingement sources, targets, and barriers provided. Also provided are updated plan and section drawings for structures classified as Important-to-Safety. These drawings show the basic floor arrangements, location of major systems and equipment, and basic building dimensions. For those structures classified as Safety Design Class, the drawings also show key structural elements, such as panel and floor reinforcements, cell liners, leak chases, major equipment anchors, and the use of masonry walls.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 7)

Title	PSAR	FSAR
4.3 Process Description	The description of process systems includes process flow diagrams for the major systems with instrumentation, sample points, and control features noted to the extent they have been developed. Heat loads are provided for heat transfer systems important to the safety analysis. Design features and parameters important to Section 4.7, "Results of the Integrated Safety Assessment", are provided. This section contains the following additional detail for each system classified as Safety Design Class: 1) The specified safety function(s) with reference to PSAR Section 4.7 for the basis 2) The design basis to be applied in the development of the system design 3) Design margins to be applied 4) The criteria to be used for the development of material specifications 5) Criteria to be used to determine design limits (such as pressure and temperature) 6) Criteria to be used to identify the need for instrumentation to monitor process conditions and the design criteria for such instrumentation (e.g., application of the single-failure criterion, and testability). For many cases, the design criteria provided are those included in the Safety Requirements Document (SRD).	This section updates the PSAR description of process systems. Process and instrumentation diagrams are provided for major systems. In addition, for those systems classified as Safety Design Class, the FSAR describes how the design requirements provided in the PSAR are reflected in the final design. For each system classified as Safety Design Class, the following are provided: 1) The specified safety function(s) with reference to Section 4.7 for the basis 2) The design basis 3) The design safety margins provided by the final design 4) Important quantitative design parameters met by the system design with their basis (e.g., heating, ventilation, and air-conditioning flow, and what established the minimum and maximum flow limits) 5) Material specifications 6) Established design limits and their basis (e.g., maximum pressure and temperature limits and what established these limits) 7) Instrumentation provided with attributes, including redundancy, diversity, in situ testability, environmental qualification, failure mode on loss of power, and the surveillance requirements as defined in Section 4.8, "Controls for Prevention and Mitigation of Accidents". The means by which the monitoring requirements established in Section 4.8 are also to be discussed in the FSAR. Potential adverse system interactions between systems of various design classification are addressed.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 8)

Title	PSAR	FSAR
4.7 Results of the Integrated Safety Analysis (ISA)	In addition to providing the results of the Process Hazards Analysis (PHA) and accident analysis, this section discusses the uncertainties of the PHA and accident analysis and relates these uncertainties to the required content of the construction authorization package. Section 4.7 provides the basis for the conclusion that resolution of the uncertainties will not have a significant impact on the construction authorization request. This discussion includes the following: 1) Characterization of the specific technical information that must be obtained to demonstrate acceptable resolution of the uncertainties 2) An outline and schedule of the program to resolve uncertainties 3) A discussion of the design and/or operational alternatives to resolve the uncertainties. Section 4.7 of the PSAR also describes the preliminary Fire Hazard Analysis (FHA) and the consequence of each design-basis fire scenario, including the consequences in the area of origin and adjacent areas.	This section documents the resolution of any uncertainties identified in the PSAR. The FSAR describes the final FHA and all resolved uncertainties previously included in the PSAR and additional fire protection measures and equipment design.
4.8 Controls for Prevention and Mitigation of Accidents	Draft Technical Safety Requirements are included.	Final Technical Safety Requirements are included.
5.0 Radiation Safety	This chapter identifies the radiological exposure standards by which the radiation safety program is developed and the facility is operated to ensure the radiological safety of the public and workers. This chapter identifies the radiation protection criteria to be implemented in the facility design.	This chapter reflects the final facility design developed to the radiation protection criteria. It also describes the facility organization and plans for the conduct of operations. This chapter includes detail on facility operation within the radiological protection program exposure standards and other radiological protection requirements.
6.0 Criticality	The methodology for criticality analyses is provided to the extent the need to perform criticality calculation is found to be appropriate. The analyses may include margins in assumptions, bounding conditions, modeling and comparisons to the acceptance criterion, as appropriate, to account for uncertainties in the design and plans for operation.	Assumptions used in the PSAR to account for uncertainties in the design and plans for operations are removed from the FSAR criticality analysis to the extent that these uncertainties have been resolved. The FSAR describes the remaining criticality controls appropriate for the RPP-WTP.
7.0 Chemical Safety	The chapter identifies the program standards by which the chemical safety program is developed and operated to protect the public and workers against chemical hazards and hazardous situations. This chapter identifies criteria to be used for the development of chemical safety controls.	The chapter reflects the final facility design and facility organization and the developed plans for conduct of operations as related to chemical safety. This section also identifies the specific chemical safety controls to be implemented for protection of the public and workers.

Table 4-2 Planned Differences Between PSAR and FSAR Content (Sheet 9)

Title	PSAR	FSAR
8.0 Fire Safety	This chapter describes automatic and manual fire protection features and administrative controls of the fire safety program. Also described are features of the ventilation system, building layout, and emergency egress routes important to fire safety.	Administrative controls to be implemented for the fire safety program are described, including final responsibilities of response forces, and the pre-fire plan used by firefighting personnel to suppress fires safely and effectively.
9.0 Emergency Management	This chapter identifies the applicable requirements and criteria to which the RPP-WTP Emergency Management Program are developed. A general outline of the program is presented and the relationship to the Hanford Site and local emergency management programs is discussed. Information is presented to demonstrate that the RPP-WTP staff will be able to attain an acceptable state of emergency preparedness by the time the facility becomes operational.	The FSAR discusses and references the specific emergency plan and implementing documentation prepared for the RPP-WTP. Specific aspects of all elements of the emergency preparedness program are discussed. Information is presented demonstrating the developed emergency preparedness program is compliant with applicable requirements, regulations, criteria and guidance, and capable of responding to any operational emergency at the facility.
10.0 Environmental Protection	This chapter references the RPP-WTP Environmental Report submitted in Part A.	This chapter references the RPP-WTP Environmental Report as a new or revised Environmental Report and is not required to support the operating authorization request.
11.0 Deactivation and Decommissioning	This chapter identifies design considerations given to facilitate deactivation and decommissioning. It also discusses in general terms, the planning, safety analysis, and regulatory considerations to be given to deactivation.	The chapter describes the specific design features included to facilitate deactivation and decommissioning. The level of detail for planning, safety analysis, and regulatory considerations to be given to deactivation is about the same as that provided in the PSAR. The FSAR is amended near the end of waste processing operation to provide more specific information regarding deactivation. (See Integrated Safety Management Plan [ISMP] Table 9-5).

4.2.3.2 Integrated Safety Management Plan

The ISMP is tailored to the various phases of the Project. It is currently focused on design and construction. However, ISMP Sections 1.3.14, “Commissioning” through 1.3.19, “Deactivation” address integrated safety management for the Project throughout the life cycle of the project (i.e., from commissioning through deactivation). In addition, the administrative controls developed for design and construction (such as training and procedures, configuration management, incident investigation, and quality assurance), are applicable to the operations and deactivation phases. As the project nears operation, the ISMP is revised to give greater attention to the conduct of operations, operational assessments, incident reporting, and maintaining the authorization basis for the facility. Near the end of waste-processing operations, the ISMP is revised again to address the hazards associated with deactivation. This ISMP revision also discusses the integration between the various deactivation activities, such as preparation of the deactivation management plan; development of the deactivation baseline, end point criteria, and surveillance and maintenance requirements; updating of the PHA; and proposed revisions to TSRs.

4.2.3.3 Safety Requirements Document

The SRD is tailored to reflect adequate control of hazards and hazardous situations associated with RPP-WTP operation. This tailoring activity includes identifying only those Safety Criteria that are required to accomplish Project activities safely, and then applying the implementing codes and standards to these criteria based on the risks posed by the hazardous situations being controlled. Features controlling hazardous situations with the potential for greater impacts (such as an offsite release affecting the public) have more rigor applied to them than those features controlling hazardous situations with lower impacts.

4.2.3.4 Technical Safety Requirements

The TSRs are based on the FSAR and any facility-specific commitments made. They are tailored to focus on the protection of public and worker health and safety. The TSRs are further tailored based on the following needs:

1) Control process variables, design features, and operating restrictions that are initial conditions (i.e., the assumed facility state) for accident analysis credited for meeting the public and worker radiological or chemical exposure standards
2) Assure that SSCs credited for achieving compliance to public and worker radiological and chemical exposure standards will function when required.

The TSRs are kept current so that they reflect the facility as it exists and as it is analyzed in the FSAR. The RPP-WTP is operated to the approved TSRs.

As the RPP-WTP operation nears the end of waste-processing operations, changes are initiated to the TSRs to control the hazards and hazardous situations associated with deactivation.

4.2.3.5 Emergency Plan

The RPP-WTP emergency management plan documents the provisions for response to operating emergencies. The emergency plan establishes effective and efficient emergency management operations that provide acceptable levels of protection for RPP-WTP workers, Hanford Site employees, and the public. The scope of the RPP-WTP emergency management program, from which the emergency plan is derived, is determined by performing a Hazards Survey and Assessment for the facility.

The Hazards Survey briefly describes the potential impacts of emergency events or conditions and summarizes applicable federal, state, and local planning and preparedness requirements. The Hazards Survey identifies the required scope of the RPP-WTP emergency management program.

If the Hazards Survey identifies hazardous materials at the facility in excess of predetermined thresholds, a facility-specific Hazards Assessment is performed. A Hazards Assessment includes the identification and characterization of hazardous materials specific to the facility, analyses of potential accidents or events, and evaluation of potential consequences. The Hazards Assessment provides the technical basis for the RPP-WTP emergency management program and includes information sufficient to determine the scope and extent of the specific elements that make up the emergency management program. These program elements, along with their bases, are documented in the emergency plan. The extent of planning and preparedness directly corresponds to the type and scope of hazards present and the potential consequences of accidents and events.

5.0 Process Safety Management

The Facility may contain highly hazardous chemicals in amounts that exceed the thresholds listed by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals" (the Process Safety Management [PSM] Standard). Among these chemicals are, for example, anhydrous ammonia and nitric acid. If threshold quantities of hazardous chemicals were exceeded, it would be necessary to develop a PSM program that complies with OSHA requirements and with similar requirements of the prevention program in the U.S. Environmental Protection Agency (EPA) Risk Management Program, 40 CFR 68, "Chemical Accident Prevention Provisions".

Even though compliance with 29 CFR 1910.119 and 40 CFR 68 does not apply to the RPP-WTP, the Project must comply with the top-level process safety management principles in Section 5.0 of DOE/RL-96-0006, *Top Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b). Because the top-level principles mirror most of the elements of the PSM standard (with the exception of employee involvement and trade secrets), a program that satisfies the OSHA PSM standard also satisfies the top-level principles.

This chapter focuses on the management systems that ensure the RPP-WTP operates safely, from the perspective of applying commercial industry practices and approaches that are compliant with PSM.

5.1 Process Safety Information

A compilation of written process safety information is maintained to enable the RPP-WTP employees involved in operating processes to identify and understand the hazards posed by those processes involving hazardous chemicals. The following information is retained:

1) Toxicity information
2) Permissible exposure standards
3) Physical data
4) Reactivity data
5) Corrosivity data
6) Thermal and chemical stability data
7) An assessment of the effects of inadvertently mixing different materials

Most of this information is available in Material Safety Data Sheets, which are made accessible to all employees. Information on interactions is prepared in the form of an interaction matrix developed for the Process Hazard Analysis (PHA). The interaction matrix for the RPP-WTP is provided in Section 4.2, "Chemical Interactions", of the Hazard Analysis Report (HAR). A list of the process chemicals used in the RPP-WTP and their hazardous characteristics is also provided in the HAR Section 4.1.2, "Process Chemicals".

Information pertaining to the technology of the process is also required. This information includes the following:

1) Block flow diagrams and simplified process flow diagrams
2) The process chemistry
3) The maximum intended inventory
4) Safe upper and lower limits for such variables as temperatures, pressures, flows, and compositions
5) An evaluation of the consequences of deviations, including effects on the health and safety of employees.

Process technology information is developed as the design evolves. Confirmation that the process safety equipment is appropriate for the process operation is established from engineering review of the completed design and the updated hazard and accident analysis. Changes in the technology are reviewed by PHAs and controlled by the configuration management process.

Another group of information is required that pertains to equipment in the process. This information includes the following:

1) Materials of construction
2) Process and instrumentation diagrams
3) Electrical classification
4) Relief system and design basis
5) Ventilation system design
6) The design codes and standards employed
7) Material and energy balances
8) Safety systems (e.g., interlocks and detection or suppression systems).

This information is assembled as the design evolves.

The RPP-WTP configuration management system ensures that Process Safety Information is maintained and kept up to date. Section 1.3.16, "Configuration Management", of the Integrated Safety Management Plan (ISMP) provides a summary of the Facility configuration management program. Additional details on this program are provided in Initial Safety Analysis Report (ISAR) Section 3.1, "Configuration Management".

5.2 Control of Subcontractors

BNI is responsible for ensuring that all subcontractors work as safely as the BNI employees. BNI's responsibilities include the following:

1) Informing the subcontractors of known fire, explosion, or toxic hazards relating to the subcontractor's work and the process
2) Explaining to the subcontractor the applicable provisions of the emergency plan
3) Developing and implementing safe work practices to control the entrance, presence, and exit of subcontractor employees, including their presence in areas of the process covered by the PSM standard
4) Periodically evaluating the performance of subcontractors in fulfilling their obligations as stated
5) Maintaining an illness and injury log relating to the subcontractor work in the process areas

Each subcontractor's responsibilities include the following:

1) Ensuring that subcontractor employees are trained in the work practices necessary to safely perform their assignments
2) Ensuring that subcontractor employees are instructed in the known hazards of the process as related to their job assignments, and in the relevant provisions of the emergency management plan
3) Documenting that each subcontractor employee has received and understood the training required to work safely at the RPP-WTP
4) Ensuring that each subcontractor employee follow the safety rules of the RPP-WTP and the site safe work practices, and advise the contractor of any unique hazards presented or found during the course of the subcontractor's work

Project environment, safety, and health (ES&H) requirements are imposed on subcontractors in contracting documents. This includes commitments included in the SRD and ISMP. Subcontractors are required to appoint an ES&H representative who is the interface with the Project team on all ES&H matters.

Before starting any work, ES&H personnel meet with the subcontractor's workers to apprise them of the job-specific ES&H requirements. In addition, oversight is provided of all subcontractor safety and compliance activities.

The system employed on the Project to track subcontractor work includes procedures with detailed checklists and specific record keeping and reporting requirements. The key elements of this system are subcontractor pre-qualification, worker job-specific training, day-to-day monitoring, and regular reporting to the contractor. These elements are described in the paragraphs that follow.

The QAP requires that subcontractors and suppliers providing services and items Important-to-Safety submit their quality plans to Project QA for review and approval.

The QAM describes how the procurement of items and services is controlled to ensure conformance with specified requirements. Audits of suppliers and subcontractors are described in the QAM.

Controls are established by the Project to ensure that purchased items and services conform to the procurement documents. These controls include provisions for source evaluation and selection, objective evidence of inspection at the subcontractor's source, examination of items or services upon delivery, and assessments. Verifications of subcontractors' and suppliers' activities during fabrication, inspection, testing, and shipment of materials, equipment, and components are planned and performed with the Quality Assurance organization participation to ensure conformance with the purchase order requirements.

Subcontractors and suppliers develop procedures for the disposition of items, materials, and services that do not meet procurement requirements to ensure that incorrect or defective items, materials, and services are not used in the RPP-WTP and that reporting requirements are satisfied. BNI validates that approved suppliers can continue to provide acceptable items and services based on a documented evaluation of their past performance.

Pre-qualification. Subcontracting procedures contain subcontract language to ensure that BNI subcontractors understand their obligation to comply with the Project ES&H programs and procedures and all applicable federal, state, and local requirements. Subcontractors are also required to submit an extensive ES&H history form documenting their capability of meeting these obligations. Subcontractors are also required to submit their safety and health program for Project review. Before work is carried out, subcontractors are required to validate that their workers have current training for the work activities they are to perform. This training must be documented as quality assurance records.

Day-to-day monitoring. The subcontractor's ES&H performance is measured against their contractual obligations and ES&H performance. This oversight is the responsibility of the project team, which includes ES&H professionals familiar with the subcontractor scope and the specific ES&H project requirements. Instructions for compliance oversight are specified in the BNI subcontracting procedures and policies. These procedures also contain guidance to initiate contract termination if a subcontractor is found to be in default of these contract obligations, including failure to respond to ES&H infractions.

Regular reporting. Subcontractors maintain their own records of accidents and illnesses and are responsible for notifying BNI immediately of any lost work day injuries/illnesses, occupational fatalities, OSHA-recordable injuries, hazardous material or radiation exposure, or property damage in excess of $500 occurring in areas under BNI control. Subcontractors are also responsible for environmental compliance as defined by applicable procedures, regulations, and laws. These submittals are reviewed by ES&H professionals to give BNI an early warning of performance degradation and to allow BNI to take effective, preventative action when necessary.

The above approaches are formalized in Project policies, procedures, and instructions. Appropriate training is also provided at all levels including employees, supervisors, and management.

To ensure that BNI subcontractors are performing their work safely, both formal and informal safety reviews and audits are performed. Results of these evaluations are transmitted to both Project management and to the affected subcontractors.

5.3 Configuration Management

The configuration management program ensures that the RPP-WTP establishes and maintains consistency among design requirements, physical configuration, administrative controls, and facility documentation to the technical baseline throughout the operating and deactivation phases. Procedures are developed to manage changes to process chemicals, technology, equipment, and procedures, together with changes to facilities that affect a covered process. The procedures ensure that, prior to a given change, the following considerations are addressed:

1) The need to perform an unreviewed safety question (USQ) evaluation
2) The impact of the proposed change on the authorization basis (i.e., RL/REG-97-13)
3) The technical basis for the proposed change
4) The impact of the change on safety and health
5) Modifications to operating procedures
6) Schedule consideration for completion of the activity
7) The authorization requirements for the proposed change
8) The training of employees who are affected by the change prior to commissioning of the process or the affected part of the process
9) Necessary changes in the process safety information and the authorization basis
10) The potential need for changes to the Technical Safety Requirements
11) Necessary changes to the master equipment list.

In the chemical process industries, the above requirements are addressed by a Management of Change procedure. The Management of Change procedure is considered the central element of PSM and its primary purpose is to ensure that change is managed safely. For the Project, the Management of Change procedure is part of the configuration management system that goes beyond the requirements of 29 CFR 1910.

The ISMP Section 1.3.16, “Configuration Management”, provides a summary of the Facility configuration management program. Additional detail on this program is provided in ISAR Section 3.1, “Configuration Management”.

The configuration management program database includes Safety Design Class and Safety Design Significant SSCs. The database relates design information and requirements to the applicable SSCs and associated documentation. The inter-relational nature is such that proposed or identified changes to any part of the controlled design, configuration, or documentation identifies other affected design, configuration, or documentation entities for which consideration of acceptability of the change must be addressed. Within the database are the performance specifications for Safety Design Class and Safety Design Significant electrical and mechanical equipment. These specifications include the conditions under which the equipment must function during the accident condition (e.g., load, pressure, voltage, temperature, radiation field, and humidity).

A proposed change would be disapproved if:

1) The change was found to compromise safety
2) The change would result in non-compliance with a regulation or law
3) The change would result in non-compliance with the contract.

5.4 Compliance Audits

Compliance audits for the PSM program are conducted by BNI at least once every three years to verify that the procedures, practices, and maintenance activities developed to ensure nuclear and process safety are adequate and being followed. These compliance audits are performed by individuals knowledgeable of the process. The audits are often performed with the aid of a checklist. A report of the audit findings is developed in which corrective actions and their schedule for completion are provided. Additional detail on this program is provided in ISAR Section 3.6, “Audits and Assessments”.

5.5 Process Hazards Analysis

The PHA is a key element in achieving and maintaining safety throughout the life of the RPP-WTP. The PHA technique evolves as the design matures. The appropriate technique is chosen by using the methodology recommended by the American Institute of Chemical Engineers (AIChE) in its *Guidelines for Hazards Evaluation Procedures* (AIChE 1992). At the conceptual design stage, a preliminary hazard analysis is used. As the design matures, the chosen technique is the Hazard and Operability (HAZOP) Analysis.

Thus, the PHA technique is tailored to the information available and to the complexity of the RPP-WTP processes. In addition, the chosen techniques are among those in the list of acceptable techniques promulgated by OSHA in 29 CFR 1910.119 (e) (2). A discussion of the hazards analysis techniques selected for the Facility is discussed in HAR Section 3.2, “Selection of a Hazard Evaluation Methodology”. Application of the selected techniques is discussed in HAR Section 3.3, “Hazard Evaluation Methodology”.

The chosen PHA techniques address the hazards of the process by systematically evaluating potential deviations from design intent caused by the failure of engineered or administrative controls, including appropriate detection methodologies that provide early warning of release. Human factors are addressed by identifying those causes of deviations from design intent that are caused by human error. Further detail on human factors is given in ISMP Section 3.12, “Human Factors”.

OSHA also requires that the PHA consider how accidents in the process can affect other areas, such as the control room, office buildings, or other nearby structures and processes. Also, the PHA team considers how external events might affect the process. This is accomplished by considering these siting issues in the context of the causes and consequences of the deviations from design basis. The discussion of causes and consequences includes a review of previous incidents at the site and at similar facilities. For the Facility, considerations for siting are addressed in HAR Section 2.1, “Site Description”, and the comparison the results of the PHA to those of other facilities is provided in HAR Section 4.4, “Comparison to Similar Facilities”. The consideration of consequences also includes a qualitative evaluation of the possible effects on the health and safety of facility workers.

A written plan will be developed in Part B for participation of employees and their representatives in the conduct of the PHA and other elements of the Project PSM program.

The documentation of the PHA is consistent with the examples of documentation given in the AIChE's *Guidelines for Hazards Evaluation Procedures* (AIChE 1992). The results of the PHA for the Facility are included in HAR Section 6.0, "Hazards Analysis Results Summary".

The results of the PHA are submitted to the regulator for review to support the construction authorization package, operating authorization package, and deactivation request as discussed in ISMP Section 9.2, "Scheduling of Events for Regulatory Submittals". The schedule for these submittals of the PHA is shown in ISMP Figure 9-1. The PHA, including revisions, is maintained by the document control process discussed in Chapter 8.0, "Document Control and Maintenance". Access to the PHA and other PSM information is made available to employees.

The PHA is performed in accordance with the requirements of the Project QAP. This includes establishment of personnel training and qualification requirements, confirming that personnel meet these requirements, application of management reviews, and documentation of results.

5.6 Conformance to Other Top-Level Safety Standards and Principles

This section addresses the attributes of a PSM program dealing with procedures and training, maintenance of the HAR, hot work operations, mechanical integrity, commissioning review, incident investigations, and emergency actions.

5.6.1 Procedure Development

Operating procedures provide clear instructions for safely operating the RPP-WTP during commissioning, normal operations, temporary operations, emergency shutdown, emergency operations, normal shutdown, and process startup following a turnaround or emergency shutdown. The procedures cover conditions under which emergency shutdown is required and assignment of shutdown responsibility to qualified operators, thus ensuring that emergency shutdown is executed in a safe and timely manner.

The procedures consider the consequences of deviations from outside normal operating limits and the steps required to correct those deviations. They contain safety and health considerations, such as the properties of, and hazards presented by, the chemicals used in the process. The procedures also contain the precautions necessary to prevent exposure, including engineered features, administrative controls and personal protective equipment, and control measures to be taken if physical contact or airborne exposure occurs. The procedures also address safety systems and their operation, and control of hazardous chemical inventory levels.

The operating procedures are periodically reviewed for human factors considerations and to ensure that they reflect current operating practice. The operating procedures are readily accessible to employees who work in or maintain a process. Safety Criteria 7.2-6, 7.2-7, and 7.2-8 of Volume II of the Safety Requirements Document (SRD) provide criteria for procedures required to implement PSM.

All operations that may affect safety are carried out in accordance with approved procedures that clearly delineate responsibility. Procedures provide step-by-step instructions on how to operate the facility or equipment routinely and safely. Some procedures are developed prior to the commissioning phase and serve to discipline the testing design intent to confirm facility operation to the design. During this phase, procedures are tested to demonstrate that they provide adequate direction for safe performance of facility operations.

There is a defined hierarchy of operating procedures, the position within which depends the safety significance of the operation to which the procedure refers. For example, procedures supporting the implementation of Technical Safety Requirements (TSR) or credited as defense-in-depth features for accident prevention and mitigation have a greater safety significance than those supporting operations with a lower impact on safety. Operator training emphasizes the importance of this hierarchy as well as the need to follow all procedures to carry out facility operations safely and efficiently.

The term “operating procedures” covers the entire range of procedures important for safe and efficient facility operations, in addition to those that detail routine facility operations. Procedures are provided for maintenance and emergency situations as well as day-to-day operations.

5.6.2 Updating of the Hazard Analysis Report

At least annually after the receipt of hazardous material at the RPP-WTP, the PHA and HAR are updated by a qualified team. This is to assure that the process hazard analysis is consistent with the current process. The PHA and HAR are also updated as required by the configuration management program.

Additional control of the HAR is provided by SRD Safety Criterion 3.1-7 which requires that changes in the processes or assumptions be accurately reflected in the hazards analysis. Changes to process or assumptions occurring between periodic updates of the hazards analysis are governed by the USQ process (described in ISMP Section 3.16.4, “Unreviewed Safety Questions”, and described in ISAR Section 3.1, “Configuration Management”) and by control of the authorization basis as described in ISMP Section 3.3.2, “Control of the Authorization Basis”. The periodic reviews and updates of the hazards analysis are performed in accordance with the Safety Criteria of SRD Volume II, Section 3.1, “Hazards Analysis”, governing the conduct of the hazards analyses, as implemented and described in ISAR Section 4.9, “Administrative Control of the Integrated Safety Assessment”.

5.6.3 Development of the Operator Training Program

The operator training program is developed and implemented in accordance with SRD Volume II, Section 7.2, “Training and Procedures”. Details on the Project training and qualification programs are provided in ISMP Section 3.4, “Safety/Quality Culture”, and Section 3.15, “Training and Qualification”. ISAR Section 3.4, “Training and Qualification”, further addresses the training policy and describes the level of training required to receive to efficiently and safely perform their intended duties.

The BNI program implements the above-referenced SRD criteria which contain a requirement to develop an operator training program that includes an overview of the facility processes and operating procedures, the specific safety and health hazards, operating limits, emergency operations, safe work practices, and refresher training.

Each employee involved in operating a process is trained in an overview of the process and in the operating procedures and instructions. The training includes emphasis on the specific safety and health hazards, operating limits, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.

Refresher training is provided at least every 3 years for PSM activities, and more often if necessary, to each employee involved in operating a process to ensure that the employee understands and adheres to the current operating procedures and instructions of the process and is proficient in the procedures to follow if conditions exceed the design basis of the facility.

5.6.4 Commissioning Review

Prior to operation of the RPP-WTP with radioactive materials and chemicals considered to pose a hazard, commissioning tests of the facility systems and personnel are performed in accordance with the Safety Criteria of SRD Volume II, Section 6.0, "Commissioning". This testing confirms that Safety Design Class and Safety Design Significant structures, systems, and components (SSC) are capable of performing their specified safety functions and personnel are knowledgeable and proficient in the performance of procedures. A review is also performed to ensure that the necessary safety, operating, maintenance, and emergency preparedness procedures are in place and adequate prior to operation of the facility. The content of the commissioning plan is provided in ISAR Section 3.10, "Testing Program and Preoperational Safety Review".

5.6.5 Mechanical Integrity

Procedures are established to maintain the integrity of process equipment, including pressure vessels and storage tanks, piping systems and pipe-mounted components, relief and vent systems and devices, emergency shutdown systems, controls (including monitoring devices and sensors, alarms and interlocks), and pumps. Inspections and tests that follow generally accepted good engineering practices are performed on process equipment. The frequency of inspections and tests is determined by manufacturer's recommendations, good engineering practices, and the vulnerability of components to the effects of aging, modified as necessary by operating experience. Inspection and test results are documented. Equipment deficiencies identified by the inspections or tests are corrected in a safe and timely manner.

The Project training program includes the training of each employee involved in maintaining the integrity of process equipment.

The Project QAP includes requirements for procedures to ensure that equipment, as fabricated, is suitable for the process application for which it will be used. Checks and inspections are performed to ensure that equipment is installed properly, and is consistent with design specifications and the manufacturer's instructions. A spare parts management system ensures that maintenance materials, spare parts, and equipment are suitable for the process application for which they are used.

Central to maintaining chemical and radiological exposures at a minimum is the requirement to maintain the mechanical integrity of SSCs. Maintenance activities related to this requirement are categorized as follows:

1) Routine
2) Planned replacement
3) Preventative
4) On demand (i.e., in response to failures).

The requirement for mechanical integrity is dependent on the duty of the equipment and its accessibility for routine inspection and maintenance. Therefore, in-cell equipment (which resides in a high radiation area) requires a higher level of reliable mechanical integrity than readily accessible out-cell equipment. The other important factor that influences the required degree of integrity is the role of the SSC in accident prevention or mitigation. Appropriate mechanical integrity of facility equipment is ensured using the following methods:

1) Early identification of safety significance and maintenance requirements (e.g., degree of accessibility and reliability)
2) Application of the appropriate manufacturing standards and quality assurance
3) Facility (equipment) acceptance testing
4) Inspection and monitoring requirements (preventative maintenance)
5) Training and maintenance instruction requirements.

5.6.6 Hot Work Operations

Hot work operations are reviewed and conducted in accordance with SRD Safety Criterion 4.5-19 which governs administrative controls to minimize fire hazards. These controls include those governing the use of ignition sources, reviewing proposed work activities for fire protection impacts, and the establishment of compensatory controls for activities that may impair fire prevention or mitigation features. The fire protection program is described in detail in ISAR Section 8.0, “Fire Safety”.

Implementation of other safety work practices, such as system and equipment tagout, use of scaffolding, and confined space entry, are also developed. They are addressed in detail in ISAR Section 3.11, “Operational Practices”.

5.6.7 Investigations of Incidents

For incidents that have the potential to result in a major accident or a release of hazardous or radioactive material from the controlled area of the RPP-WTP, an investigation is conducted in accordance with the Safety Criteria of SRD Volume II, Section 7.7, "Reporting and Incident Investigation". Incidents are categorized as soon as possible and, in all cases, within 2 hours as Emergency, Unusual, and Off-Normal occurrences. When the categorization is not clear, the occurrence is conservatively categorized at the higher level. Investigation of the incident is initiated as promptly as possible, but not later than 48 hours following the incident. The focus of the RPP-WTP incident investigation program is the identification of the events and near misses, determination of root causes, identification of corrective actions, dissemination of information to the lessons learned program, reporting of incidents, and the monitoring of the effectiveness of corrective actions. Additional information on incident investigation is provided in ISMP Section 3.16.3, "Incident Investigations". The incident reporting procedure and additional detail on the incident investigation program is contained in ISAR Section 3.7, "Incident Investigations".

An incident investigation team is established for incidents that have the potential to result in a major accident or a release of hazardous or radioactive material from the controlled area. The team consist of at least one person knowledgeable in the process involved, including a subcontract employee if the incident involved work of the subcontractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident. A report is prepared at the conclusion of the investigation. The report is reviewed with all affected personnel whose job tasks are relevant to the incident findings. The incident report includes as a minimum:

1) Date of incident
2) Date investigation began
3) A description of the incident
4) Results of the root cause analysis
5) The factors that contributed to the incident
6) Any recommendations resulting from the investigation.

A system is established to promptly address, resolve, and document the incident report findings and recommendations.

The incident categorization is one factor used in determine the extent of the incident investigation in terms of the size of the investigation team, its independence, and the depth of the root cause analysis. By this process, the extent of the incident investigation is tailored to the consequences of the event or the potential consequences of a "near miss". For example, by tying the incident investigation to the event categorization, an increasing level of investigation is applied to the following events: 1) a hazardous substance release that exceeds 50% of a CERCLA reportable quantity; 2) a chemical release that violates environmental requirements in state or federal permits; and 3) a chemical release that had reported effects on collocated workers.

The categorization process is not the only factor that determines the extent of the incident investigation. For example, incidents that are repeat occurrences will receive more in-depth investigation, in part, to determine the reason for ineffectiveness of the corrective actions. Where repeat incidents or recurring causes are indicated, prompt follow-up action is initiated to identify additional corrective actions needed to preclude recurrence. These additional corrective actions are tracked to completion and their adequacy verified to ensure correction of the problem. An evaluation also is conducted for repeat occurrences to determine if the trend represents a programmatic failure reportable under 10 CFR 820.

The investigative process is used to gain an understanding of the incident, its causes, and corrective actions necessary to prevent recurrence. The process is summarized below.

1) The scope and depth of analysis of a particular incident is tailored to the significance of the incident. The tailoring of the analysis (i.e., incident investigation) is in part dependent on the categorization of the incident, if the incident is a repeat occurrence, and if the incident is considered a significant condition adverse to quality.
2) If the investigative process warrants a team investigation as determined from the evaluation above, at least one member of the investigative team is assigned from the organization most closely involved with the activities that were ongoing at the time of the event or incident. This member provides detailed first-hand knowledge of the performance of the activities. Other members are independent, and all members are knowledgeable of facility design and operations or are experts in safety (industrial or process).
3) At least one member is formally trained in at least one of the various industry-accepted methods of incident investigation and cause determination.
4) The team investigates the event, identifies underlying causes, formulates corrective action recommendations, and documents the results of the investigation.
5) The incident investigation process, its implementation, and its effectiveness are reviewed periodically by the Project Safety Committee or by audits or assessments.

5.6.8 Emergency Action Plan

For accidents that result in the need to take additional actions to protect the public and workers, and the environment from accidental releases of hazardous or radiological material, an emergency response program is provided in accordance with the Safety Criteria of SRD Volume II, Section 7.8, “Emergency Preparedness”. Emergency preparedness is addressed in ISMP Section 3.10, “Emergency Preparedness”. The Emergency Response Plan is outlined in ISAR Section 9.0, “Emergency Management”. This ISAR section describes how the plan complies with the requirements of 29 CFR 1910.38, “Employee Emergency Plans and Fire Protection”, 40 CFR 355, “Emergency Planning and Notification”, DOE/RL-94-02, *Hanford Emergency Response Plan*, (DOE-RL 1994) and DOE/RL-96-0006, *Top-Level Radiological, Nuclear, and Process Safety Standards and Principles for TWRS Privatization Contractors* (DOE-RL 1996b).

6.0 Integrated Safety Management

This chapter describes how safety management is integrated into work planning and performance. Lines of responsibility and authority for environment, safety, and health (ES&H) issues are described. Personnel qualification, resource allocation, and hazard assessments, controls, and operating conditions are discussed.

6.1 Integration Into Work Planning and Performance

The Project safety management process protects the public, workers, and the environment through implementing work practices that never compromise safety for the sake of production or expediency. This is achieved by BNI by way of the following:

1) Conduct activities in an atmosphere of trust and confidence based on open, honest, and responsible communication
2) Encourage employee feedback
3) Use proven and effective approaches to risk identification and control
4) Conduct business with integrity and mutual respect for employees and interfacing organizations
5) Apply a systematic approach to all activities that affect ES&H
6) Establish clear ownership and accountability
7) Define and reach agreement with the employees on the work to be accomplished by the facility operation and the expectation to accomplish the work in a safe manner
8) Promote teamwork through involvement of knowledgeable parties
9) Empower employees to effectively protect themselves, the public, and the environment
10) Allocate appropriate resources to support ES&H activities
11) Support continuous improvement of ES&H performance
12) Manage and conduct a consistent and project-wide integrated approach to ES&H for all activities
13) Encourage and promote sharing ES&H information and resources
14) Assignment of a qualified person for overall responsibility for the development, implementation, and integration of the safety management process.

Application of the above work practices allows the BNI team to effectively implement BNI guiding principles for integrating safety management into work planning and performance efforts. These guiding principles include establishing line management responsibility for ES&H, establishing and making clear lines of authority, ensuring that personnel have the necessary qualifications to perform the work, providing effective allocation of resources, performing pre-work hazard assessments, establishing appropriate controls for hazards and hazardous situations, and establishing operational requirements.

These work practices and principles are an integral part of the BNI team safety culture. They are formalized in Project policies, procedures, and instructions and are incorporated into all activities described in the following sections. The flowdown of these work practices and principles to subcontractors is discussed in Section 5.2, "Control of Subcontractors".

6.1.1 Line Management Responsibility for ES&H

Line management responsibility and accountability for ES&H is one of the key principles of the BNI approach to ES&H integration. To ensure maximum effectiveness in ES&H performance, employees are informed of their responsibility and accountability for creating and maintaining a safe and healthy workplace and protecting the environment.

In addition, ES&H individuals do not assume roles that reside with the line organization. This creates an environment where accountability is clearly focused and ES&H priorities are never sacrificed to another line mission or objective.

6.1.2 Lines of Authority and Responsibility

Clear and unambiguous lines of authority and responsibility are established throughout the Project through its design, construction, operation, and deactivation phases. The flowdown of ES&H responsibility and accountability starts with the Project Manager during construction and the Facility Manager during operation (which includes deactivation) and extends through the management and supervisory chain to each worker, irrespective of the type of work being performed. This flowdown is captured in policies and procedures, communicated to the workforce through orientation and training, reinforced by group and individual performance evaluations, and monitored and assessed by independent oversight provided by ES&H professionals.

Stop-work authority also flows down from senior management to individual workers who are explicitly empowered to halt any activity in which they are engaged that is unsafe or potentially harmful to the environment.

6.1.3 Personnel Qualification and Resources

The Project training provides personnel with the knowledge, skills, and direction necessary to perform their duties in a safe and environmentally sound manner. Training is performed using a tailored approach, commensurate with the level of risk and individual responsibility.

The Project training addresses relevant ES&H requirements and is provided at all levels of the organization as follows.

1) Employees are trained to ensure they recognize, understand, and anticipate the hazards and the environmental requirements associated with performing their work.
2) Supervisors are trained to ensure they understand their responsibilities for assisting employees in analyzing the work for safety hazards and environmental compliance requirements; to assist employees in maintaining physical protection at work sites; and to enforce (and reinforce) performance standards, protective measures, and environmental practices.

3) Managers are trained to understand their responsibilities for providing necessary ES&H support and direction to supervisors, employees, and subcontractors and for demonstrating ES&H leadership through their actions and communications.

Resources are assigned to ensure that protection is provided for the public, workers, and the environment. The risk assessment process, discussed in Section 6.1.4, "Hazard Assessments, Controls, and Operating Conditions", provides the key input to the resource allocation process by identifying the significant risks associated with RPP-WTP work activities.

6.1.4 Hazard Assessments, Controls, and Operating Conditions

The performance of hazard assessments, the specification of appropriate controls, and the establishment of safe operating conditions are all achieved through the use of a risk assessment system that ensures that all significant risks are identified. The RPP-WTP risk assessment system evaluates tasks and the work environment to anticipate, recognize, evaluate, and control situations, conflicts, and stressful situations, and other conditions that may significantly affect the health, safety, or efficiency of the Project employees. Each of the following basic components of the systems is performed with a degree of rigor based on the scope of the work effort and commensurate with the potential hazardous situation it presents as follows.

1) Pre-job planning encompasses the task description, expected hazards and hazardous situations, protection methods, anticipated exposure levels, waste generation, and emergency response.
2) Baseline evaluations determine the status of a facility area or system.
3) Integrated hazard analyses detail the evaluations of the potential hazards and the controls needed to protect the public, personnel, and the environment.
4) Radiological work planning outlines routine and special radiological controls, precautions, surveillances, and instructions to personnel, as well as prerequisite conditions (e.g., tagouts and system isolations).
5) Assessments and surveillances including formal and informal appraisals, monitoring, and oversight activities to verify that specific elements of the policies, programs, plans, and procedures are being effectively implemented; that work is being performed safely; and appropriate compliance and commitment tasks are being performed.
6) Investigations of work-related injuries or illnesses, near misses, motor vehicle accidents, property damage, environmental spills and releases, fires, and explosions through accident and incident response to identify the root cause and contributing causes of the event and the corrective actions necessary to prevent recurrence.

The above safety management processes provide a coherent, integrated, and formalized methodology to ensure that the risks associated with potential health, safety, and environmental hazards and hazardous situations are identified and properly addressed, and that the RPP-WTP can be operated safely and in compliance with environmental regulations.

7.0 Regulatory Interfaces

This chapter describes the BNI interface with regulatory agencies regarding environmental protection, occupational health and safety, and safeguards and security. Section 7.4 "Resolution of Conflicting Requirements and Standards" covers the resolution process when standards and requirements conflict.

7.1 Environmental Protection Interface

The U.S. Department of Energy (DOE) and the State of Washington have analyzed the environmental impacts from treatment of tank waste by vitrification in the Tank Waste Remediation System (TWRS) Environmental Impact Statement (EIS). This EIS satisfied both the requirements of the *National Environmental Policy Act* and the *State Environmental Policy Act*. In addition, the Record of Decision (62 FR 8693) for the TWRS-EIS selected the phased implementation option that called for the deployment of two Phase I facilities to treat the tank waste.

To support the Record of Decision resulting from the TWRS-EIS, the BNFL team prepared an environmental report (ER) in accordance with the requirements of 10 CFR 1021.216, "Procurement, Financial Assistance, and Joint Ventures". The environmental report updates the information provided by the DOE and the Washington State Department of Ecology (Ecology) in the EIS.

The Environmental Protection Agency (EPA) has provided Ecology and the Washington Department of Health (DOH) the authority to permit air emissions including those from the Facility. Ecology is responsible for regulating criteria pollutants and toxic air pollutants (WAC 173-460 and 173-400). The DOH regulates radioactive emissions.

Ecology regulates the RPP-WTP with respect to the *Resource Conservation and Recovery Act of 1976* (RCRA). The regulations for the management of dangerous waste are found in WAC 173-303. A contract Part A deliverable is a Draft Dangerous Waste Permit Application for review by the DOE. Many meetings with Ecology to date have focused on the Draft Dangerous Waste Permit Application to obtain early benefit of input from Ecology.

The WTP project team identified all of its environmental permits and monitoring in an Environmental Plan. In addition to the air permits and the Dangerous Waste Permit Application, the plan identified activities to be performed by the team during Part B to protect the environment.

To support early development of the Environmental Plan, the BNFL team prepared a Permitting Plan in conjunction with the DOE, Ecology, and the DOH. This plan provided the tentative dates for major permitting activities for the RPP-WTP. In addition, the Permitting Plan documented all of the permitting interfaces with other DOE waste treatment, storage, and disposal facilities, and provides public involvement opportunities. The Permitting Plan was approved and signed by representation of DOE, Ecology, DOH, and the WTP contractor.

BNI participates in information exchanges with the environmental agencies through routine Permitting Task meetings and workshops. Ecology and the DOH are regular participants in these meetings along with DOE. BNI maintains communication with the regulatory agencies through these meetings, occasional technical meetings on specific topics, and by numerous discussions either in person or by telephone to exchange additional information.

7.2 Occupational Health and Safety Interface

BNI complies with all applicable federal, state, and local safety and health regulations to ensure occupational health and safety for RPP-WTP workers. The project occupational safety and health program is regulated by the US Department of Energy (DOE).

The DOE has drafted a memorandum of understanding with the OSHA for the DOE to provide onsite observation of OSHA compliance similar to that conducted by the U.S. Nuclear Regulatory Commission (NRC) at nuclear reactors. BNI responds to observations provided by the DOE to both the OSHA and the DOE. In addition, any responses to OSHA inquires are sent to both entities.

BNI ensures non-radiological safety and health (i.e., occupational health and safety) compliance with applicable regulations by the design, testing, and maintenance of structures, systems, and components and through administrative controls to address health and safety hazards. The identification and mitigation of occupational health and safety hazards occurs through application of the RPP-WTP Project non-radiological worker health and safety program and, for hazardous materials above threshold quantities, compliance with the Process Safety Management (PSM) regulation found in 29 CFR 1910.119, as discussed in ISMP Section 5.1, “Process Safety Information”. Identification of hazards includes the use of Material Safety Data Sheets and other methods as specified in 29 CFR 1910.1200, “Hazard communication”. The Project maintains records of compliance activities as part of the protocols found in ISMP Chapter 8.0, “Document Control and Maintenance”, to support non-radiological safety and health inspections.

7.3 Safeguards and Security Interface

The preliminary assessment of the composition of candidate radioactive waste feeds indicated the quantities and types of special nuclear materials (SNM) to be handled at the RPP-WTP should be classified as Attractiveness Level E and Nuclear Material Safeguards Category IV. These are the lowest classification levels. Safeguards and security requirements for SNM appropriate for the RPP-WTP will be developed with DOE. These considerations will be consistent with the economic and strategic value of the materials present at the facility. Any conflicts that arise between considerations for safeguards and security and radiological, nuclear, and process safety will be resolved by discussions among BNI and the DOE.

7.4 Resolution of Conflicting Requirements and Standards

Conflicting standards and requirements can arise internal to the radiological, nuclear, and process safety regime and external to this regime. The Project safety management process addresses both types of conflicts as described below.

Internal Conflicts

Internal conflicts are identified as a direct consequence of the Project approach to design. The ISMP Section 4.1.3, "Development of Safety Management Programs", describes how the Safety Requirements Document (SRD) is linked to the design process to ensure that standards are properly implemented. Because all standards and requirements information flows down into lower level design guides (see Figure 4-2), internal conflicts are recognized. At this point, the process established to maintain the SRD is used to resolve the conflict. The process for maintaining the SRD is described in SRD Volume I, Section 3.6, "Maintenance of the SRD".

External Conflicts

To ensure that current regulatory requirements and regulatory changes are promptly and accurately identified, BNI team members maintain access to multiple regulatory resources, as discussed in Section 2.1.

When the potential applicability of an existing, new, or revised regulatory requirement is identified, any conflicts are resolved. The impact on project cost and schedule, along with the feasibility of implementing the requirement, are included in the evaluation.

Routine meetings with the regulator offer a forum for identification and discussion of external conflict issues. Letters between the regulating agencies and the BNI team provide formal documentation of issue resolutions.

In the cases where safety and environmental regulations conflict, absent the granting of an exemption from the regulation, the more stringent regulation is followed.

The nature of taking responsibility for operation of the double-shell tank AP-106 requires the resolution of a number of interface concerns. From an early stage, interface meetings were held among the WTP Project contractor, the DOE, and the Project Hanford Management Contractor (PHMC) to identify and resolve these concerns. Interface responsibilities are agreed on and recorded in interface control documentation. Adding concerns to this documentation and accepting their resolution requires approval of all parties involved with the interface issue.

8.0 Document Control and Maintenance

The Quality Assurance Manual (QAM) requirements for the Project records management system is provided in Section 5, “Instructions, Procedures, and Drawings”, Section 6, “Document Control”, and Section 17, “QA Records” of the QAM (BNI 2001).

Documents are prepared, reviewed, approved, issued, and revised to prescribe processes, specify requirements, and establish design. Safety documents developed as a part of the safety management process controlled by the QAP include but are not limited to those identified in Table 8-1. The column “Records” lists the documents that address the items in the “Subject” column.

Table 8-1 Safety Management Records (Sheet 1)

Subject	Records
Authorization basis	• Integrated Safety Management Plan • Safety Requirements Document • Radiation Exposure Standard for Workers Under Accident Conditions • Preliminary Safety Analysis Report • Final Safety Analysis Report • Technical Safety Requirements • Quality Assurance Plan and Implementation Plan • Radiation Protection Program • Emergency Plan • Safety Evaluation Reports • Written communication with the regulator • Safety analyses
Design	• Master equipment list • Software verification and validation • Equipment and system testing requirements • Equipment qualification requirements • Facility and equipment description and drawings • Design control procedures • Design Criteria and bases for Safety Design Class and Safety Design Significant structures, systems, and components (SSC) • Records of facility changes (configuration management) and associated integrated safety analyses • Specifications for Safety Design Class and Safety Design Significant SSCs • ALARA documents
Construction	• Records of site characterization measurements and data • Construction procedures • Inspection and test records • Construction material certifications • Calibration and test records • Nonconforming condition reports and closure records • Procurement specifications • Craft qualification records

Table 8-1 Safety Management Records (Sheet 2)

Subject	Records
Management Organization and Administration	• Administrative procedures with safety implications • Performance Plans • Employee concerns program, discipline, and employee action records (for protected activities) • Evidence of deliberate misconduct • Organization charts, position statements, training, and qualification records • Safety and health compliance records, medical records, and personnel exposure records. • Safety statistics and trends • Incident reports • Technical and experience qualifications (design, construction, and operation)
Operations	• Commissioning test results • Operating logs • Maintenance records • Calibration and testing data • Material balance, inventory, transfer, and disposal records • Material storage records • Facility operating procedures • Change control records for Safety Design Class and Safety Design Significant procedures • Operator aids (e.g., charts and drawings used to assist operator in performing job) • Training records • Special test records • Corrective action determination and close-out reports • Unreviewed safety question screening and evaluation reports • Records pertaining to disposal of radioactive and mixed wastes
Integrated Safety Analysis	• Integrated Safety Analyses and supporting data, analyses, calculations, and documents • Change control records for Safety Design Class and Safety Design Significant changes to facility • List of Safety Design Class and Safety Design Significant SSCs • Methods for setting acceptable safety limits and controls (including nuclear criticality safety) • Fire hazard analysis • Initial Safety Analysis Report • Hazard Analysis Report
Radiological Safety	• Radiation protection (and contamination control) records • Radiation Work Permits • Radiation protection training records • Records pertaining to radiological process incidents, unusual incidents, and accidents • Individual monitoring (10 CFR 835.702) • Monitoring and workplace (10 CFR 835.703) • Administrative (10 CFR 835.704) • ALARA records • Dosimetry records • Release of property and equipment • Exposures exceeding applicable limits • Records pertaining to sealed sources, accountability, and control • Receipt and transportation or radioactive materials

Table 8-1 Safety Management Records (Sheet 3)

Subject	Records
Nuclear Criticality Safety	• Nuclear criticality control procedures and statistics* • Records pertaining to nuclear criticality incidents, unusual incidents, and accidents* • Records pertaining to nuclear safety analyses (* criticality analysis may show these records to be unnecessary)
Chemical Safety	• Chemical process safety procedures • Records pertaining to chemical process inspections, audits, investigations, and assessments • Chemical process safety reports and analyses • Chemical process safety training
Fire Safety	• Hot-work permits and fire-watch records • Records pertaining to inspection, maintenance, and testing of fire protection equipment • Records pertaining to fire protection training • Pre-fire emergency plans
Emergency Management	• Review of emergency plan from outside emergency response organizations and supporting entities • Memoranda of understanding with outside emergency response organizations • Records pertaining to the training of personnel involved in emergency preparedness functions • Emergency drill and exercise records • Records pertaining to inspection and maintenance of emergency response equipment and supplies
Environmental Protection	• Environmental release and monitoring records • Environmental Report • Environmental Permits (e.g., air, water, and waste)
Occupational Safety and Health	• Material Safety Data Sheets • Training records of staff and contract employees • Inspection and testing reports • Equipment deficiency reports and resolution
Deactivation and Decommissioning	• Deactivation records • Incident reports to support decommissioning (e.g., radiological and chemical spills)
Quality Assurance	• Training and qualification/certification records • Audit and assessment procedures and reports • Surveillance reports • Nondestructive testing procedures, calibration data, and test results • Calibration results • Nonconforming condition reports and closure documentation • Defective and counterfeit items • Procurement documentation • Supplier assessments and vendor inspections • Project review of vendor drawings • Certified vendor information

9.0 Scheduling of Safety-Related Activities

This chapter provides the sequence of events for safety-related activities and deliverables for the design, fabrication and construction, commissioning, operation, and deactivation phases of the Project. The safety-related activities to be conducted during these phases are also presented.

9.1 Scheduling Safety-Related Activities

Figure 9-1 shows the sequence of events and interdependencies between the safety-related Part B activities. A schedule addressing Figures 2, 5, 6, and 7 of DOE/RL-96-0003, *DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors*, (DOE-RL 1996a) was provided in BNFL Inc. letter of November 4, 1998 (reference 000500).

Tables 9-1 through 9-5 describe key safety-related activities and show the assignment of these activities to functional areas.

9.2 Scheduling of Events for Regulatory Submittals

This section addresses the scheduling of regulatory submittals required by DOE/RL-96-0003, *DOE Regulatory Process for Radiological, Nuclear, and Process Safety for TWRS Privatization Contractors* (DOE-RL 1996a) and the Safety Requirements Document (BNFL 1997d). Figure 9-1 provides the sequence of events for the following deliverables to DOE.

1) The construction authorization package, which will include the Preliminary Safety Analysis Report (PSAR). The PSAR will address Items 1-5, 7-15, 18, and 20 of DOE/RL-96-0003, Section 4.3.2, “Contractor Input”, (DOE-RL 1996a). The remaining items will be provided separately from the PSAR.
2) The operating authorization package, which will include the Final Safety Analysis Report (FSAR). The FSAR will address Items 1-5, 7-9, 12, 15, 17, 18, 20, 21, and 23 of DOE/RL-96-0003, Section 4.4.2, “Contractor Input”, (DOE-RL 1996a). The remaining items will be provided separately from the FSAR.
3) The submittal of the deactivation authorization request. This will include revision to the Integrated Safety Management Plan (ISMP) to provide additional detail on deactivation activities.

The self-assessment documents identified in Item 4 of DOE/RL-96-0003, Section 4.5.2, “Contractor Input” are provided to the DOE within 90 days of the completion of the assessment.

Revisions to the Quality Assurance Program will be submitted to the DOE with the standards approval package for construction, operation, and deactivation which is submitted fourteen weeks prior to the scheduled authorization request submittal.

Figure 9-1 Sequence of Safety Related Activities (Sheet 1 of 3)

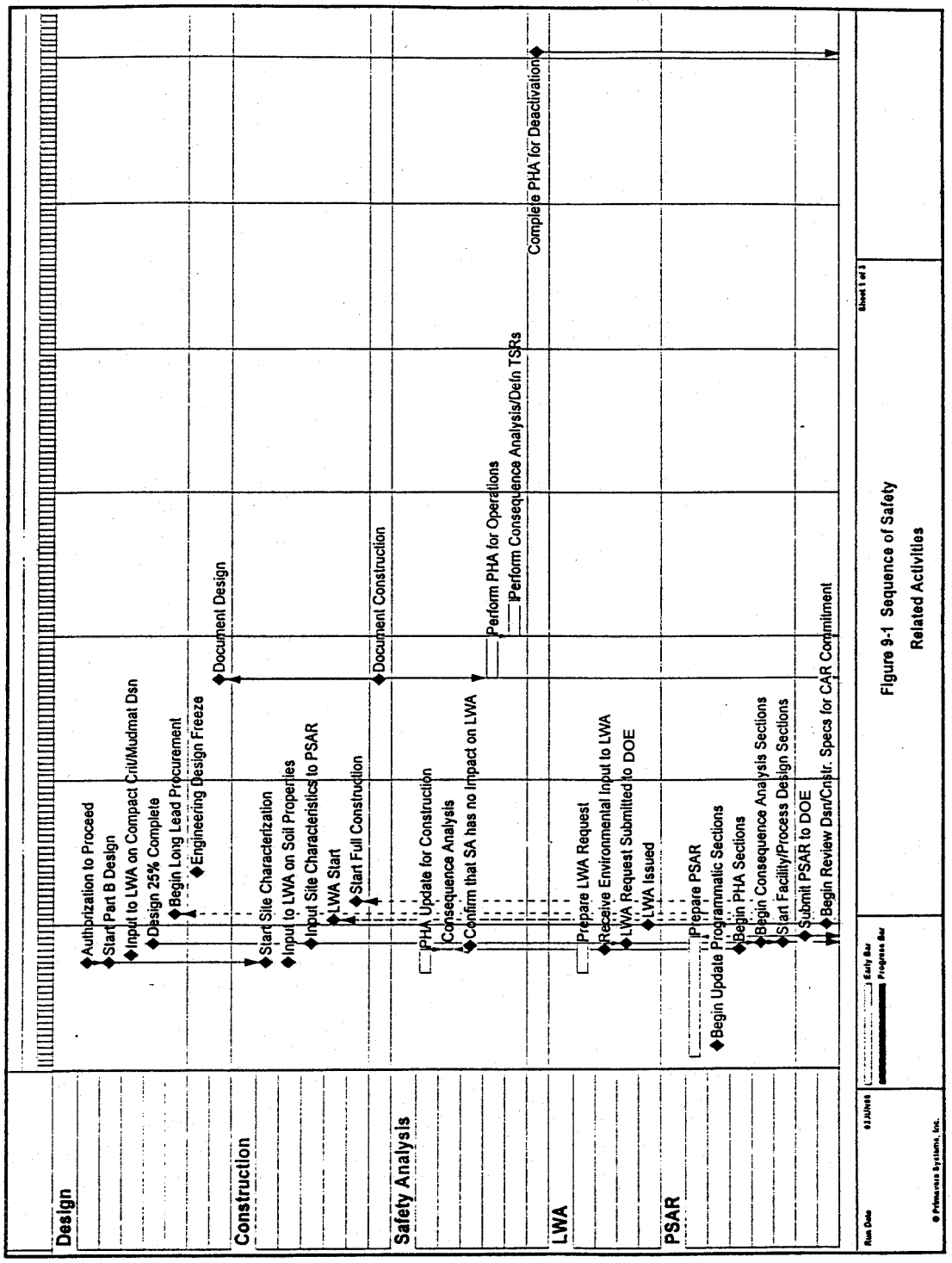


Figure 9-1 Sequence of Safety Related Activities (Sheet 2 of 3)

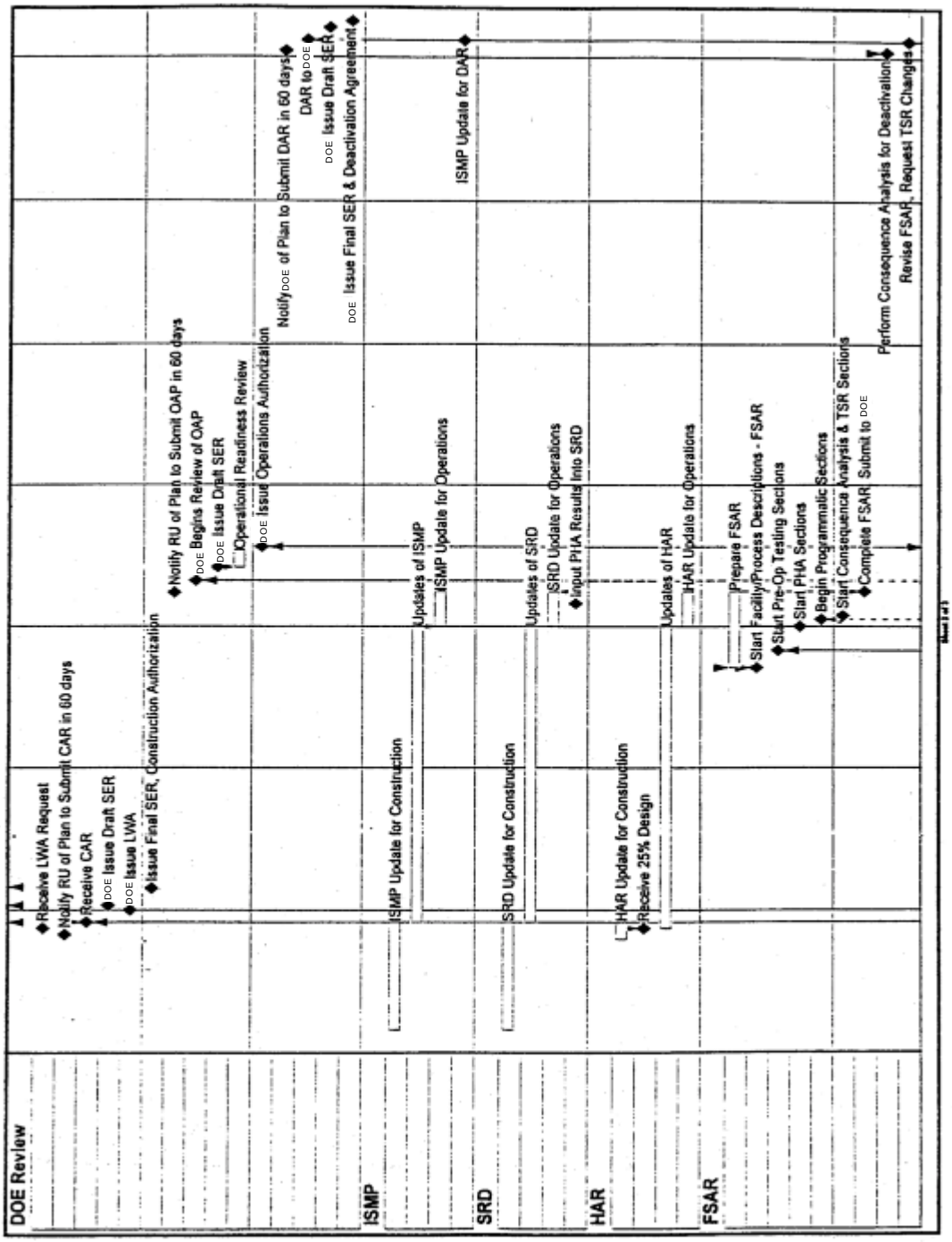


Figure 9-1 Sequence of Safety Related Activities (Sheet 3 of 3)

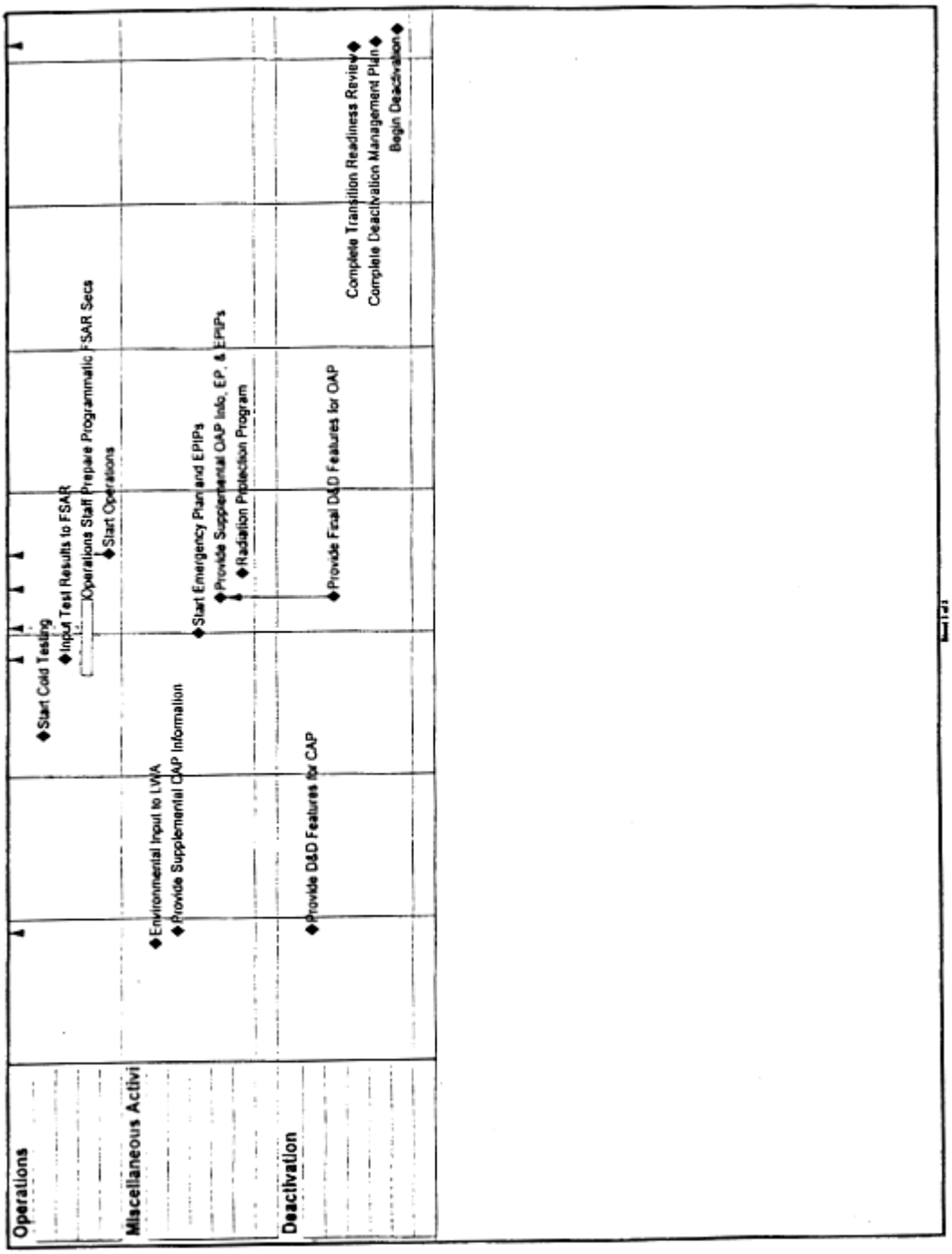


Table 9-1 Key Safety-Related Activities – Design Phase (Sheet 1)

Safety-Related Activities	Functional Area
Planning:	
• Define safety policy and objectives	• Project Management
• Define critical safety interfaces for the various phases of the project	• Project Management
• Implement safety policy and objectives	• Line Managers, all functional areas
• Assign roles for safety-related activities	• Project Management
• Develop procedures to implement safety objectives and organizational plans	• Environment, Safety, and Health
• Develop plans and procedures to address internal safety and oversight functions	• Environment, Safety, and Health
• Develop plans and procedures to address quality assurance and quality control functions	• Quality Assurance
• Develop plans and procedures for identification and resolution of employee concerns	• Human Resources
• Develop performance measures	• Project Management
• Develop employee feedback program	• Project Management
• Develop configuration management program	• Configuration Management
• Develop and implement a regulatory commitment tracking system	• Environment, Safety, and Health
Analysis / Regulatory:	
• Update Process Hazards Analysis (PHA)	• Environment, Safety, and Health
• Update Hazard Analysis Report	• Environment, Safety, and Health
• Identify requirements of the facility design for environmental regulatory compliance	• Environmental Protection
• Identify requirements of the facility design for Occupational, Safety, and Health (OSHA) Administration compliance	• Environment, Safety, and Health
• Prepare applications for state and federal environmental permits	• Environmental Protection
• Update Standards Requirements Document	• Environment, Safety, and Health
• Update Integrated Safety Management Plan	• Environment, Safety, and Health
• Prepare limited work authorization request	• Environment, Safety, and Health
• Prepare Preliminary Safety Analysis Report	• Environment, Safety, and Health

Table 9-1 Key Safety-Related Activities – Design Phase (Sheet 2)

Safety-Related Activities	Functional Area
Design Functions:	
• Develop the quality assurance program plan for the design phase	• Quality Assurance
• Develop facility design that will achieve the defined work activity and satisfy commitments of the construction authorization package	• Engineering
• Incorporate into the design measures that minimize the hazards associated with processing and storing radioactive liquid and solid waste, and fissionable materials	• Engineering
• Incorporate into the design measures to facilitate performance of Technical Safety Requirement surveillances	• Engineering
• Incorporate design features to ensure personnel exposure is as low as reasonably achievable	• Engineering
• Identify design requirements for security	• Environment, Safety, and Health
• Incorporate design requirements for security	• Engineering
• Implement consideration for deactivation and decommissioning into the facility design	• Engineering
• Verify and validate design products against safety requirements	• Engineering
• Implement configuration management control program	• Configuration Management
• Define acceptance criteria for the construction testing program	• Engineering
• Perform systematic design reviews to determine readiness to authorize construction of Safety Design Class and Safety Design Significant systems, structures, and components	• Engineering

Table 9-2 Key Safety-Related Activities – Fabrication and Construction Phase

Safety-Related Activities	Functional Area
Construction:	
• Implement quality assurance program plan for the construction phase	• Quality Assurance
• Incorporate regulatory and quality commitments into procurement, fabrication, inspection, and testing	• Engineering
• Incorporate regulatory requirements and quality commitments into facility construction, procurement, fabrication, inspection, and testing specification, training, and procedures	• Engineering and Construction Management
• Implement procedures and training to enhance construction safety	• Engineering
• Develop a program to ensure that the designer's configuration management program is implemented and that as-built information critical to safety is supplied to the facility operator	• Configuration Management
• Develop procedures for hazardous material handling, packaging, labeling, and shipping practices	• Construction Management
Inspection and Testing:	
• Conduct audits and inspections that verify compliance to requirements by the construction contractor, subcontractors, and Safety Design Class and Safety Design Significant suppliers of systems, structures, and components	• Quality Assurance
• Implement construction testing program to verify that SSCs meet acceptance testing requirements	• Construction Management
• Perform a systematic review(s) to determine readiness to authorize facility turnover in preparation for commissioning testing	• Environment, Safety, and Health

Table 9-3 Key Safety-Related Activities – Commissioning Phase

Safety-Related Activities	Functional Area
Planning:	
• Develop objective and scope for startup testing (scope to include initial and boundary conditions and simulated single failures, as appropriate)	• Technical Support
• Identify the role of design and accident analyses organizations in the identification of the tests to be performed and acceptance of the test results	• Technical Support
• Develop testing program that emphasizes testing with non-radioactive streams	• Operations
• Identify tests to be performed and their acceptance criteria	• Technical Support
• Develop the quality assurance program plan for an operating facility	• Quality Assurance
• Develop operating staff training program	• Operations
• Conduct staff training	• Operations
• Develop program for procedure preparation, review, validation, approval, change, deviation, and internal control	• Operations
• Define the maintenance program that includes preventive, predictive, and corrective maintenance practices and incorporates vendor-recommended maintenance activities	• Technical Support
• Develop operating procedures	• Operations
• Develop administrative procedures	• Operations
• Develop maintenance procedures	• Maintenance
• Develop procedures for hazardous material handling, packaging, labeling, and shipping practices	• Technical Support
• Prepare Final Safety Analysis Report	• Environment, Safety, and Health
• Implement a process safety management program	• Environment, Safety, and Health
Startup Testing:	
• Write test procedures	• Technical Support
• Develop processes for evaluating and resolving unreviewed safety questions and for requesting discretionary enforcement relief from Technical Safety Requirements	• Environment, Safety, and Health
• Perform testing and document results to acceptance criteria	• Operations
• Collect safety component and process baseline data for future performance monitoring and maintenance planning	• Configuration Management

Table 9-4 Key Safety-Related Activities – Operations Phase

Safety-Related Activities	Functional Area
Planning Prior to Facility Operations:	
• Develop Technical Safety Requirement (TSR) surveillance testing and evaluation program	• Environment, Safety, and Health
• Provide independent internal oversight review to ensure facility operation within the authorization basis	• Environment, Safety, and Health
• Develop the radiation protection program	• Radiation Protection
• Develop emergency response procedures	• Operations
Facility Operation:	
• Implement the operational phase quality assurance program	• Quality Assurance
• Implement the emergency preparedness plan including conduct of emergency exercises	• Operations
• Implement the radiological protection program	• Radiation Protection
• Implement a monitoring, evaluation, and reporting program in compliance with the operating authorization	• Environment, Safety, and Health
• Implement the operational phase program for internal safety and oversight functions	• Environment, Safety, and Health
• Implement performance measures and feedback systems	• Facility Management
• Implement a management assessment function	• Facility Management
• Implement a maintenance program	• Maintenance
• Perform testing and monitoring required by the TSRs	• Maintenance
• Operate facility to achieve defined work activity and within the operating authorization and authorization basis	• Facility Manager
• Perform incident investigations including reporting, root cause analyses, identification of corrective actions, and tracking of effectiveness of corrective actions and apply lessons learned from relevant facilities	• Environment, Safety, and Health
• Maintain an operating history to facilitate deactivation of the facility	• Configuration Management

Table 9-5 Key Safety-Related Activities – Deactivation Phase

Safety-Related Activities	Functional Area
Planning:	
• Define deactivation interfaces for surveillance, maintenance, and deactivation	• Technical Support
• Develop the surveillance and maintenance criteria and end point criteria	• Technical Support
• Assign roles and responsibilities for safety-related activities for deactivation	• Facility Manager
• Identify deactivation measures that minimize hazards associated with treating and storing radioactive, liquid, and solid waste, and fissionable materials	• Technical Support
• Prepare deactivation management plan	• Technical Support
• Modify plans and procedures addressing internal safety and oversight functions for deactivation phase	• Environment, Safety, and Health
• Modify plans and procedures addressing quality assurance and quality control functions for the deactivation process	• Quality Assurance
• Develop deactivation performance measures	• Facility Manager/Technical Support
• Develop/modify operating and maintenance instructions for post-deactivation operational equipment	• Maintenance
• Develop design modifications to facilitate deactivation	• Technical Support
Analysis / Regulatory:	
• Perform a job hazard analysis and update the Hazard Analysis Report	• Environment, Safety, and Health
• Identify critical aspects of facility deactivation that would effect environmental regulatory compliance	• Environmental Protection
• Prepare applications for changes to state and federal environmental permits	• Environmental Protection
• Prepare a deactivation Safety Analysis Report and modify facility authorization basis	• Environment, Safety, and Health
Deactivation:	
• Initiate the quality assurance program plan for the deactivation phase of the facility	• Quality Assurance
• Implement facility modifications to facilitate performance of Technical Safety Requirement surveillances	• Technical Support
• Initiate deactivation	• Operations
• Monitor deactivation activities to ensure personnel exposure meets as low as reasonably achievable objectives	• Radiation Protection
• Verify and validate the deactivation process against safety requirements	• Environment, Safety, and Health
• Confirm the facility has achieved a passive state that meets the end point criteria	• Environment, Safety, and Health

During operation of the RPP-WTP, reports will be submitted to DOE that report the following:

1) The quantity of each principal radionuclide in excess of background released to the unrestricted area in liquid and gaseous effluents
2) The calculated annual dose to the maximally exposed members of the public
3) The calculated collective dose to members of the public.

In addition, the PHA and HAR are reevaluated and updated annually.

Figure 9-1 does not provide a schedule for the initial safety assessment as the figure addresses only Part B activities. The initial safety assessment package was delivered to the Regulatory Unit in December 1997 as part of the Part A activities (BNFL 1997c).

9.3 Flow of Safety-Related Work and Deliverables

Figure 9-1 shows the interdependencies between the deliverables.

The scope of the proposed Limited Work Authorization (LWA) included in Figure 9-1 provides for early initiation of construction activities. The LWA allows for excavation, backfill, recompaction, and installation of the mud mat and ground grid. The LWA request would include information on site suitability (addressing hazards from natural phenomena and nearby facilities as they would impact the requested construction activity); excavation, backfill, and recompaction criteria; stability of surface soils; design requirements and Quality Assurance Program to be applied to the requested LWA activities; current SRD standards and ISMP program applicable to LWA activities; description of planned safety-related testing to be performed during LWA activities; references to the procedures to be employed for the requested work; and the environmental impacts of implementing the requested work activity.

10.0 Assessments

Assessments of the Project verify that public and worker safety considerations are reflected in the design, procurement, construction, commissioning, operation, and deactivation of the facility. The role of safety committees in achieving these objectives is discussed in Integrated Safety Management Plan (ISMP) Section 3.16.1, "Safety Committees".

Assessments in compliance with 10 CFR 830.120(c)(3)(i) and (c)(3)(ii) involve the following:

1) Management assessments. Managers assess their management processes so that problems that hinder the organization from achieving its objectives are identified and corrected. These assessments are discussed in Section 10.1, "Management Assessments".
2) Independent assessments. Independent assessments are performed to measure item and service quality, measure the adequacy of work performance, and promote improvement. These assessments are discussed in Section 10.2, "Independent Assessments".

During the design and construction phase, assessments are directed at such activities as:

1) The development of regulatory documents
2) Performance of safety analysis
3) Qualification of personnel, training, and procedures as related to design and construction
4) Design control
5) Construction work packages
6) Worker safety
7) Fire protection
8) Equipment procurement.

Assessments during operation and deactivation provide oversight of these same areas and extend to the following areas:

1) Radiation control
2) Unreviewed safety questions evaluations
3) Compliance with the authorization basis
4) Maintenance training and work performance
5) Hazardous waste management
6) Emergency exercises
7) Compliance to deactivation end point criteria
8) Fire protection.

The following sections provide a summary of the more significant aspects of the assessment processes.

10.1 Management Assessments

Management assessments are conducted annually by the line manager of each RPP-WTP organization to measure the effectiveness of their activities in achieving public and worker safety. The assessments focus on the various functional programs for which managers have safety responsibility.

The assessments cover, but are not limited to the following:

1) Interfaces among groups with safety roles
2) Use of safety performance indicators
3) Adequacy of resources
4) Staff training and qualification
5) Supervisory oversight and support.

Management assessments involve the following:

1) Evaluating the implementation of applicable portions of the quality assurance program
2) Identifying barriers hindering the accomplishment of safety objectives, documenting response actions, and implementing corrective actions
3) Developing a plan for each management assessment that includes the schedule, scope, level of effort, and team qualifications
4) Issuing a final report with identification of problems and corrective actions
5) Evaluating the effectiveness of the corrective actions in preventing recurrences.

Section 18 of the QAM addresses the purpose and conduct of management assessments and specific managers' responsibilities in the assessment process.

10.2 Independent Assessments

Independent assessments measure the effectiveness of activities in achieving public and worker safety. The staff performing independent assessments have sufficient authority and freedom outside the line organization to carry out their responsibilities. Individuals performing independent assessments are technically qualified and knowledgeable in the areas being assessed. Independent assessments are performed to identify the following:

1) Work performance and process effectiveness
2) Abnormal performance and potential problems
3) Improvement opportunities
4) Effectiveness of root cause identification and corrective actions in preventing recurrence of previous problems
5) Lessons learned from other organizations with similar activities or concerns.

The frequency of the assessments for various functional areas is based on the following:

1) Status, complexity, and importance of the activity or process being assessed
2) Past performance of the activity or process being assessed
3) Performance indicator results and trending to ensure activities are achieving adequate public and worker safety.

Section 8 of the QAM addresses the purpose and conduct of independent assessments, independence and qualifications of assessment personnel, documentation of results, management responses and actions, and specific managers' responsibilities in the assessment process.

10.3 Corrective Action Implementation and Tracking

An administrative system is established for tracking corrective action items. Problems are evaluated and trended to determine if any should be reported in an incident report or reported under 10 CFR 820, "Procedure Rules for DOE Nuclear Facilities" as a significant noncompliance with a nuclear safety requirement. Effectiveness of the corrective actions in preventing recurrence of previous problems is evaluated in a subsequent management assessment.

10.4 Support of DOE Inspection and Corrective Action/Enforcement Action Programs

This section addresses the DOE inspection and corrective active/enforcement action programs including the Project's responsibilities relative to these programs.

10.4.1 DOE Inspection Program

The DOE inspection program is described in *Inspection Program Description for the Regulatory Oversight of TWRS Privatization Contractors*, (DOE-RL 1998b). The purposes of this inspection program are described as:

1) Confirming Contractor performance to the authorization basis and Contract in the areas of radiological, nuclear, and process safety
2) Ensuring timely identification and implementation of corrective actions such that regulatory conditions detrimental to safety and the interests of fixed-price contracting are avoided
3) Developing independent inputs for subsequent regulatory authorization or actions thereby fostering regulatory efficiency.

The DOE inspection program is executed in a planned, disciplined, and predicable manner. This is accomplished through appropriate planning, preparation, and performance of inspections and through the use of established protocols (DOE-RL 1998b).

The Project supports the DOE inspection program by:

1) Making available for DOE review, documentation such as program plans, manuals, procedures, instructions, technical reports, self-assessment reports, meeting minutes, records, data reports and event reports
2) Providing briefings and discussions and support interviews on selected subjects as requested by the DOE and prearranged with BNI.
3) Supporting on-location DOE observations of Project operations and activities as requested by the DOE and prearranged with BNI.
4) Supporting unannounced on-location DOE observation of Project construction, operation, and deactivation activities
5) Attending and supporting pre-inspection and inspection entrance and exit meetings
6) Responding to findings of DOE inspection activities.

The above-mentioned RPP-WTP operations and activities to be observed include, but are not limited to, 1) monitoring of equipment performance during operation, inspection, or testing, 2) witnessing of tests, and 3) the performance of independent analyses.

10.4.2 DOE Corrective Action/Enforcement Action Program

The DOE corrective action/enforcement actions program is described in *Corrective Action/Enforcement Action Program Descriptions* (DOE-RL 1998a). The Project supports the DOE corrective action and enforcement actions program by:

1) Self-identification of non-compliant conditions and the prompt reporting of such conditions to DOE
2) Responding to corrective action notices issued by DOE
3) Prompt implementation of a safety-rework, suspend operation, stop work, and Compliance Orders issued by the DOE.

11.0 Organization Roles, Responsibilities, and Authorities

The responsibility for the design, construction, commissioning, operation, and deactivation of the River Protection Project-Waste Treatment Plant lies with the designated RPP-WTP contractors throughout these various life-cycle phases of the Facility. These contractors to the Department of Energy, Office of River Protection will include the Design, Construction, and Commissioning (DC&C) contractor, the Operations contractor, and the Deactivation contractor.

As addressed in this ISMP, these contractor's roles, responsibilities, and authorities include defining and implementing nuclear, radiological, and process safety standards and the related safety bases for protection of the RPP-WTP occupational workers and the public. These RPP-WTP contractors have the sole responsibility for defining and implementing DOE-approved safety standards and communicating those safety standards as requirements to all RPP-WTP Project team members and subcontractors who conduct work on the Project.

While the Project team members manage subcontractors, the RPP-WTP contractors retain responsibility for oversight of team members and subcontractors performance and for overall project safety. The commitment inherent in this structure is that line management retains the responsibility for development and implementation of the safety basis. Although some specific roles may be reassigned within the organization, line management's responsibility for safety is invariant.

The RPP-WTP contractors assign safety roles to functional areas as indicated in Tables 9-1 through 9-5. Table 9-1 assigns roles for key elements of the design phase functional groups. The organization chart for the DC&C contractor organization is provided in Figure 11-1. The Operations and Deactivation contractors organization charts will be defined as the Project nears these phases of the Project. Project roles, responsibilities, and authorities for the DC&C contractor are presented in Section 11.1. Envisioned roles, responsibilities, and authorities for the Operations contractor are presented in Section 11.2.

11.1 Design, Construction, and Commissioning Contractor Organization Roles, Responsibilities, and Authorities

Safety-related roles, responsibilities, and authorities for the DC&C phase of the operation, as assigned to individuals and organizations within BNI (the DC&C Contractor), are discussed below.

Project Manager

The Project Manager safety-related roles, responsibilities, and authorities include:

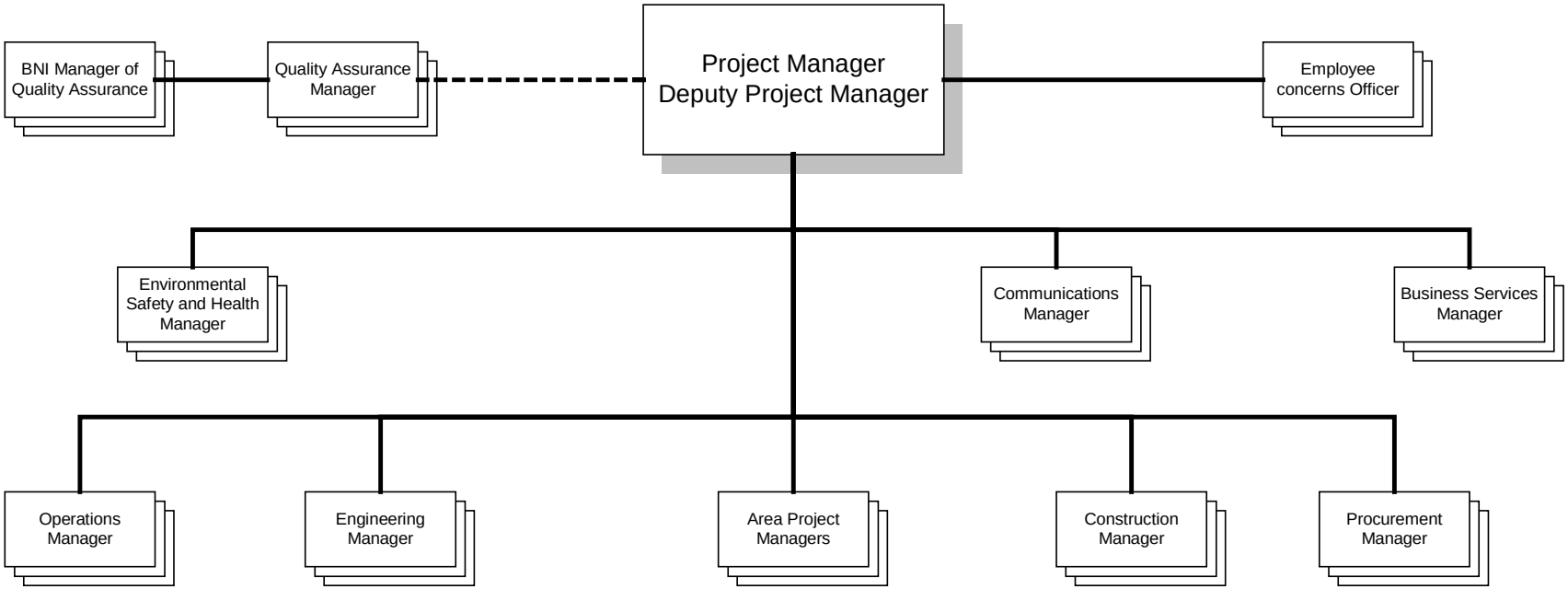
1) Responsibility for RPP-WTP safety
2) Defining safety policy, objectives, and interfaces
3) Assigning roles and responsibilities for safety-related activities
4) Setting performance expectations
5) Developing management assessment policies
6) Signatory on permit applications for construction of the Facility
7) Serving as a member of the Executive Committee
8) Ensuring implementation of the Quality Assurance Program (QAP)

Deputy Project Manager

The Deputy Project Manager safety-related roles, responsibilities, and authorities include:

1) Ensuring that the RPP-WTP is designed, constructed, tested, commissioned, operated, and maintained in a safe, reliable, and efficient manner in accordance with policies and all applicable laws, regulations, authorization bases, and technical requirements
2) Integrating nuclear and industrial safety, quality, and environmental protection into all work
3) Managing the design transition, facility and process design, construction, acceptance testing, procurement, and commissioning
4) Integrating the Area Project Managers and functional managers
5) Creating an atmosphere in the workplace where reporting and resolution of conditions adverse to quality is encouraged at all levels
6) Stopping activities within his area of responsibility, which are not accomplished in compliance with applicable authorization bases and/or regulatory requirements

Figure 11-1 Management Structure and Organization for the BNI Design, Construction, and Commissioning Contract



Area Project Managers

The safety-related roles, responsibilities, and authorities of the Area Project Managers, in their respective areas of responsibility, include:

1) Managing design and construction effort, in their respective area of responsibility.
2) Implementing management assessment policies, in their respective area of responsibility.
3) Implementing the contractor requirements of 10 CFR 820, "Procedural Rules for DOE Nuclear Activities", in their respective area of responsibility.
4) Ensuring the development and implementation of the incident reporting program, in their respective area of responsibility.
5) Ensuring approval by the Engineering Manager of final designs of Safety Design Class and Safety Design Significant features, in their respective area of responsibility.
6) Serving as principal interface with DOE on technical issues, in their respective area of responsibility.
7) Developing and managing the readiness review program to support commissioning, in their respective area of responsibility.

Engineering Manager

The Engineer Manager oversees the engineering design activities that are assigned to the DC&C contractor. The safety-related roles, responsibilities, and authorities of the Engineering Manager include:

1) Approving final designs of Safety Design Class and Safety Design Significant features
2) Updating the treatment process, civil, architectural, structural, electrical, and mechanical design criteria
3) Completing the civil, structural, support system, and facility designs including the incorporation of regulatory and quality commitments
4) Preparing specifications for procurement of pre-purchased equipment
5) Incorporating regulatory and quality commitments into the design, procurement, fabrication, inspection, and testing of systems and components
6) Designing measures to facilitate performance of Technical Safety Requirement (TSR) surveillances
7) Designing features to implement the design requirements of 10 CFR 835 Occupational Radiation Protection including features for ensuring personnel exposure during operation is as low as reasonably achievable (ALARA)
8) Selecting materials for fabrication and construction; defining methods for corrosion control; and specifying welding procedures, requirements for nondestructive examination, and codes and standards
9) Designing fire prevention, detection, and suppression features in compliance with state and federal requirements
10) Incorporating deactivation and decommissioning features into the facility design
11) Evaluating proposed changes to civil, structural, support system, and facility designs
12) Updating the process design specifications, process descriptions, basis of design documents
13) Completing the process design including the incorporation of regulatory and quality commitments

14) Developing and implementing the configuration management (CM) program to control the safety and design bases
15) Obtaining documentation defining the physical configuration of the facility and forwarding this documentation to the Project Administration and Controls Organization
16) Developing and implementing of CM program database

Construction Manager

The safety-related roles, responsibilities, and authorities of the Construction Manager include:

1) Implementing procedures and training to enhance construction safety
2) Providing input to the configuration management program including as-built information
3) Supporting the incident reporting system for construction-related incidents
4) Developing procedures for the handling of hazardous material during construction, including packaging, labeling, storage, and shipping practices
5) The packaging and manifesting of dangerous waste arising from construction activities
6) Interfacing with subcontractors on process safety management and ES&H matters
7) Incorporating regulatory and quality commitments of SSCs into the construction
8) Implementing the construction testing program to verify that SSCs meet acceptance testing requirements

Environment, Safety & Health (ES&H) Manager

The safety-related roles, responsibilities, and authorities of the ES&H Manager include:

1) Implementing internal safety and oversight functions
2) Developing safety basis and safety-related performance measures
3) Implementing the process safety management program
4) Developing and implementing the regulatory commitment tracking system, and the incident reporting program
5) Interfacing with regulators, stakeholders, and Hanford Site contractors on ES&H matters
6) Evaluating proposed changes that involve implementation of nuclear, radiological, and process safety and environmental matters
7) Implementing the fire protection program
8) Coordinating cooperative agreements with outside agencies such as fire, police, ambulance, and medical services
9) Developing and managing the ES&H portions of the readiness review program to support commissioning
10) Serving as a member of the Project Safety Committee, supporting independent safety review in the ES&H area of responsibility and serving as the PSC alternate chairperson.
11) Updating the process hazards analysis

The ES&H Manager also oversees activities related to radiological, nuclear, and process safety and environment protection. These activities include the following:

1) Identifying and evaluating new laws and regulations that may affect the Project safety programs
2) Preparing the Limited Construction Authorization (LCA) request
3) Interfacing with the regulators during onsite inspections
4) Updating the Hazard Analysis Report (HAR), Safety Requirements Document (SRD), and Integrated Safety Management Plan (ISMP)
5) Preparing the Preliminary Safety Analysis Report (PSAR) and Final Safety Analysis Report (FSAR)
6) Environmental reporting
7) Identifying requirements for worker and public safety, security, and environmental regulatory compliance
8) Preparing the environmental characterization and monitoring plans
9) Preparing permit applications and plans as required for state and federal environmental regulations
10) Monitoring environmental compliance during construction
11) Developing and implementing the Environmental Radiation Protection Program

Quality Assurance Manager

The safety-related roles, responsibilities, and authorities of the QA Manager the following:

1) Developing the Quality Assurance Program (QAP)
2) Assessing and auditing project activities to verify compliance with the QAP and other requirements and to determine the effectiveness of the QAP
3) Providing support for the development of qualification and training programs to ensure that required capabilities are achieved and maintained by project personnel
4) Reviewing project documents (e.g., design documents, nuclear and process safety deliverables, work plans, and source evaluation plans) to verify inclusion of appropriate QAP requirements
5) Recommending and exercising work stoppage or controls over further processing in response to quality concerns
6) Assessing and auditing vendor and subcontractor activities to verify compliance with the QAP and other requirements and to determine the effectiveness of the QAP
7) Serving as a member of the Project Safety Committee, supporting independent safety review in the QA area of responsibility

The QA Manager has the authority and responsibility to stop project work when the work, if allowed to continue, would result in activities or documents being in noncompliance with stated QAP requirements. The QA Manager is responsible for determining when appropriate corrective or preventative actions have been taken and for lifting the stop work order to allow work to proceed.

Operations Manager

The safety-related roles, responsibilities, and authorities of the Operations Manager include:

1) Developing a program for operations procedure preparation, review, verification, validation, approval, change, deviation, and internal control
2) Writing and maintaining operating procedures including post-deactivation activities
3) Performing administrative responsibilities including maintaining a qualified staff and ensuring effective employee performance
4) Performing radioactive commissioning testing to demonstrate compliance with the acceptance criteria and documenting the results to acceptance criteria.
5) Serving as the chairperson for the Project Safety Committee
6) Developing and managing the readiness review program to support commissioning

Research and Technology Manager

The safety-related roles, responsibilities, and authorities of the Research and Technology (R&T) Manager include:

1) Serving as a member of the Project Safety Committee, supporting independent safety review in the R&T area of responsibility.

Process Technology Manager

The safety-related roles, responsibilities, and authorities of the Process Technology Manager include:

1) Ensuring that technologies are developed and demonstrated
2) Evaluating the completed process design and proposed changes to the design
3) Identifying commissioning tests to be performed and their acceptance criteria
4) Incorporating regulatory and quality commitments into procurement, fabrication, inspection, and testing of process components
5) Performing systematic design reviews to determine readiness to authorize fabrication and construction of structures, systems, and components (SSC)
6) Implementing design considerations for deactivation and decommissioning

Commissioning Manager

The commissioning organization manages the commissioning program. The safety-related roles, responsibilities, and authorities of the Commissioning Manager include:

1) Developing the objectives and scope for the startup program
2) Developing and evaluating proposed changes to the commissioning program
3) Verifying and validating operation and maintenance procedures during performance of testing

4) Providing information from the startup program to the operations, training, and procedures groups, and maintenance for verification and validation of operating administrative controls

Business Services Manager

The safety-related roles, responsibilities, and authorities of the Business Services Manager include:

1) Implementing an employee feedback program
2) Controlling the facility policy manual (containing the Project Manager safety policy) and all procedures
3) Developing and maintaining the records management program (See Table 8-1)

11.2 Operations Contractor Organization Roles, Responsibilities, and Authorities

The envisioned safety-related roles, responsibilities, and authorities for the Operations phase of the operation, as assigned to individuals and organizations within the Operations Contract, are discussed below.

Facility Manager

Responsibilities and roles of the Facility Manager include the following:

1) Ensuring the development and implementation of facility controls to protect the health and safety of the public, and workers and to protect the environment from hazardous situations associated with the chemical and radiological hazards of the facility
2) Ensuring that operational activities are properly staffed and controlled
3) Managing operation of the facility to obtain the defined work activity while maintaining the authorization basis for the facility
4) Approving Facility activities, including modifications to Safety Design Class and Safety Design Significant SSCs
5) Ensuring that work is performed in conformance with procedures, policies, and safety requirements
6) Implementing the contractor requirements of 10 CFR 820, “Procedural Rules for DOE Nuclear Activities”
7) Serving as the Emergency Director during events categorized as emergencies
8) Assigning roles and responsibilities for activities related to safety including operations, performance improvements, safety improvements, and deactivation of the facility

Operations Manager

Roles of the Operations Manager include the following:

1) Developing a program for procedure preparation, review, verification, validation, approval, change, deviation, and internal control
2) Writing and maintaining operating procedures including post-deactivation activities
3) Performing administrative responsibilities including maintaining a qualified staff and ensuring effective employee performance
4) Performing radioactive startup testing to demonstrate compliance with the acceptance criteria and documenting the results to acceptance criteria
5) Managing daily facility operation to obtain the define work activity while maintaining compliance to the TSRs
6) Performing TSR surveillances assigned to operations and supporting those TSR surveillances assigned to the Maintenance Organization
7) Scheduling and managing process system outage activities
8) Initiating and managing deactivation
9) Obtaining an understanding of the features and limitations of the facility SSCs to facilitate radioactive startup testing, facility operation, and the development of procedures and training
10) Developing and implementing the operating staff training program
11) Writing and evaluating proposed changes to administrative procedures related to facility operation
12) Ensuring operation of support systems (e.g., electrical, instrument air, and steam)
13) Performing analysis of feed material, product, and process chemicals
14) Developing procedures for hazardous material handling, packaging, labeling, storage, and shipping practices
15) The packaging and manifesting of dangerous waste
16) Evaluating proposed changes to the radioactive startup program

Environment, Safety, & Health Manager

The ES&H Manager is a member of the PSC and serves as the PSC alternate chairperson. In addition, for the operating project the ES&H organization has the following roles:

1) Developing the emergency plan and the emergency plan implementing procedures
2) Managing emergency drills and exercises
3) Modifying plans and procedures to address internal safety and oversight functions for the deactivation phase
4) Developing deactivation safety performance measures, modification of plans and procedures, and confirmation the facility meets the safe storage criteria on completion of deactivation
5) Managing occupational health and safety
6) Obtaining monitoring, sampling, and record keeping information on facility discharges
7) Maintaining state and federal environmental permits

8) Maintaining the environmental database
9) Keeping environmental regulators informed on current status, concerns, and new data
10) Identifying critical aspects of facility deactivation that would affect environmental regulatory compliance
11) Developing the USQ identification and evaluation process
12) Developing TSR surveillance testing and evaluation program
13) Monitoring compliance to the authorization basis
14) Updating authorization basis documentation including the FSAR
15) Directing incident investigations including reporting, root cause analyses, identification of corrective actions, and tracking of effectiveness of corrective actions and applying lessons learned from relevant facilities
16) Developing a process for evaluating deficiencies to nuclear safety requirements subject to 10 CFR 820, "Procedural Rules for DOE Nuclear Activities"
17) Preparing a deactivation safety analysis report
18) Developing and implementing the Radiation Protection Program for operations that is compliant with 10 CFR 835, "Occupational Radiation Protection"
19) Performing radiation and contamination surveys and maintaining personnel exposure records
20) Informing management of conditions that could lead to exceeding radiation limits established for radiation areas or exceeding administrative limits for personnel radiological exposure
21) Monitoring deactivation activities to ensure personnel exposure meets as low as reasonably achievable (ALARA) objectives

Quality Assurance Manager

The QA Manager is a member of the PSC. Roles of the QA Organization include the following:

1) Establishing a Quality Assurance Program for operations
2) Performing independent assessments and program compliance audits
3) Reviewing the project quality procedures and documenting compliance with applicable QAP requirements
4) Modifying and implementing quality assurance plans and procedures for the for deactivation process
5) Verifying implementation of corrective action measures and determining that the solutions for quality problems are effective

The QA Manager has the authority and responsibility to stop project work when the work, if allowed to continue, would result in activities or documents being in noncompliance with stated requirements. The QA Manager is responsible for determining when appropriate corrective or preventative actions have been taken and for lifting the stop work order to allow work to proceed.

Engineering Manager

The Engineering Manager a member of the PSC. Roles of the Engineering organization include the following:

1) Evaluating startup test results and comparing the results to acceptance criteria
2) Developing and evaluating proposed design improvements and changes to engineered features
3) Supporting resolution of production problems
4) Developing the surveillance and maintenance criteria for facility operations
5) Identifying measures that minimize hazards associated with treating and storing radioactive waste, and for the safe handling of fissionable materials
6) Performing a job hazard analysis and participating with ES&H to update HAR
7) Updating the process hazards analysis (PHA) to support permit and authorization basis updates
8) Preparing and implementing a deactivation management plan that includes:
   - updating the HAR
   - defining surveillance and maintenance criteria for deactivation and safe storage
   - developing facility modifications to facilitate performance of surveillance tests
   - implementing measures that minimize hazards associated with treating and storing radioactive materials

Maintenance Manager

The Maintenance Manager oversees the activities of the Maintenance organization. Roles of the Maintenance organization include:

1) Defining and implementing a maintenance program that includes preventive, predictive, and corrective maintenance practices and incorporates vendor-recommended maintenance activities and equipment history
2) Performing TSR surveillances assigned to maintenance and supporting those TSR surveillances assigned to operations
3) Implementing facility modifications
4) Developing and modifying operating and maintenance instructions for post-deactivation operational equipment
5) Writing maintenance procedures
6) Collecting and processing baseline data for system and component performance monitoring and maintenance planning

Procurement and Property Manager

The Procurement and Property Manager's safety related roles, responsibilities, and authorities include:

1) Providing the processes and procedures for procuring items and services important to safety.
2) Providing full support to the Quality Assurance Program described in the *Quality Assurance Manual* (QAM), thereby assuring that all work performed under his or her cognizance will conform to and support the requirements of the QAM.

Startup Manager

The Startup organization manages the startup testing program. Additional roles of the Startup Manager include the following:

1) Evaluating proposed changes to the startup program
2) Verifying and validating operation and maintenance procedures during performance of testing
3) Providing information from the startup program to the operations, training, and procedures groups, and maintenance for verification and validation of operating administrative controls

Configuration Management Manager

The Configuration Management Manager oversees the activities of the Configuration Management organization. Roles of the Configuration Management organization include the following:

1) Continued implementation of the operational configuration management program
2) Maintaining the facility operating history to facilitate deactivation of the facility

Administration and Controls Manager

The Administration and Controls Manager continues those activities started by the DC&C contractor Business and Project Controls Organization

12.0 Definitions

In the following list, the parenthetical information following the term being defined is the source of the definition. However, for sources other than DOE/RL-96-0006 (DOE 1996b) or the BNFL Inc./DOE contract (DOE-RL 1996c), the wording provided may be tailored to the Project use and therefore may not be exactly as contained in the referenced source.

Accident Risk Goal (DOE/RL-96-0006 [DOE-RL 1996b]). The risk, to an average individual in the vicinity of the Contractor's facility, of prompt fatalities that might result from an accident should not exceed one-tenth of one percent (0.1%) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population generally are exposed.

By footnote 14 of DOE/RL-96-0006, for evaluation purposes, individuals are assumed to be located within 1 mile of the contractor's controlled area.

Acute Hazard (AIChE 1992). The potential for injury or damage to occur as a result of an instantaneous or short duration exposure to the effects of an accident.

Administrative Controls. Provisions relating to organization and management, procedures, record keeping, assessment, and reporting necessary to ensure safe operation of the facility.

As Low as Reasonably Achievable (10 CFR 835). The approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. The ALARA approach is not a dose limit but a process that has the objective of attaining doses as far below the applicable limits of this part (10 CFR 835) as is reasonably achievable.

Authorization Basis (DOE/RL-96-0006 [DOE-RL 1996b]). The composite of information provided by a Contractor in response to radiological, nuclear, and process safety requirements that is the basis on which the Director of the Regulatory Unit grants permission to perform regulated activities.

Changes (RL/REG-97-13). Changes to the facility design and administrative controls that are described in the authorization basis or are relied upon by the Contractor to ensure conformance to the authorization basis. Included within the scope of "Changes" are those items that may not be explicitly described in the authorization basis, but where Changes would cause a deviation from commitments contained in the authorization basis.

As used above, "facility" refers to the physical facility, the hazards and safety analysis of the facility, and the work at the facility that is enveloped by the analyses. The facility is described in the authorization basis by information such as: the site description, design information, hazard analysis information, safety analysis information, and descriptions of facility operations, tests, and experiments.

As used above, "administrative controls" refers broadly to the management and administrative processes associated with managing, designing, building, or operating the facility. Administrative controls are described in the authorization basis by information such as the descriptions of procedures, programs, plans, and management processes.

Codes and Standards. Document containing expressed expectations for the performance of work; normally refers to those practices issued by consensus organizations (e.g., American National Standards Institute, American Society of Mechanical Engineers, and National Fire Protection).

Co-located Worker (DOE/RL-96-0006 [DOE-RL 1996b]). An individual within the Hanford Site, beyond the Contractor-controlled area, performing work for or in conjunction with DOE or utilizing other Hanford Site facilities.

Common-Cause Failures (DOE/RL-96-0006 [DOE-RL 1996b]). Dependent failures that are caused by a condition external to a system or set of components that make system or multiple component failures more probable than multiple independent failures.

Common-Mode Failures (DOE/RL-96-0006 [DOE-RL 1996b]). Dependent failures caused by susceptibilities inherent in certain systems or components that make their failures more probable than multiple independent failures due to those components having the same design or design conditions that would result in the same level of degradation.

Consequence (AIChE 1992). The direct, undesirable result of an accident sequence usually involving a fire, explosion, or release of toxic material. Consequence descriptions may be qualitative or quantitative estimates of the effects of an accident in terms of factors such as radiological exposure, health impacts, economic loss, and environmental damage.

Consequence Analysis (AIChE 1992). The analysis of the effects of incident outcome cases independent of frequency or probability.

Controlled Area (DOE/RL-96-0006 [DOE-RL 1996b]). The physical area enclosing the facility by a common perimeter (security fence). Access to this area can be controlled by the contractor. The controlled area may include identified restricted areas.

Deactivation (Contract, Section J, Attachment 9 [DOE-RL 1996c]). The process of permanently ceasing active operation at a facility in a planned and controlled manner to support follow-on decontamination and decommissioning activities. A process whereby non-essential systems and/or equipment in a shut down facility are de-energized, drained and flushed, isolated, or removed to minimize the long-term costs of maintaining the facility in a physically safe and environmentally secure condition. Includes the removal of fuel and stored radioactive and/or hazardous waste from the facility and implementation of appropriate facility safety requirements.

Deterministic Analysis. A non-probabilistic approach to accident analysis that begins with the establishment of a specific set of credible accident initiating events expected to represent a range of possible challenges to the safety of the facility and some of which are expected to define the design requirements for the facility. The design of the facility is then evaluated to this set of events using conservative inputs and assumptions to account for uncertainties, to ensure that adequate controls exist to protect the public and workers such that radiological and chemical exposure standards are satisfied. In the evaluation of public and worker safety, the most limiting random single active failure of a system or component is assumed and credit is taken only for those structures, systems, and components that meet Safety Design Class requirements. Other than selecting credible events to account for accident likelihood, this is a consequence-oriented rule-followed approach (i.e., assume worst single failure) to establish the design of the facility.

Regulatory Unit (DOE/RL-96-0006 [DOE-RL 1996b]). The organization reporting to the Director of the Regulatory Unit dedicated to supporting the Director in executing regulatory authority.

Double-shell Tank (Contract, Section J, Attachment 9 [DOE-RL 1996c]). A reinforced concrete underground vessel with two inner steel liners to provide containment and backup containment of liquid wastes; annulus is instrumented to permit detection of leaks from the inner liner. At the Hanford Site, there are 28 double-shell tanks.

Emergency Response Planning Guidelines (AIChE 1992). A system of guidelines for airborne concentrations of toxic materials prepared by the American Industrial Hygiene Association (AIHA).

Engineered Feature. A structure, system, or component that contributes to the safe operation of the facility.

Episodic Event (AIChE 1992). An unplanned event of limited duration, usually associated with an accident.

ERPG-2 (AIHA 1988). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

External Event. An event external to the RPP-WTP caused by (1) a natural hazard (e.g., earthquake, flood, lightning, or range fire) or (2) a human-induced event (e.g., transportation or nearby industrial activity).

Facility Worker. An individual within the controlled area of the facility performing work for or in conjunction with the Contractor or utilizing Contractor facilities. This is the same as the definition of 'worker' in DOE/RL-96-0006 which is "Worker means an individual within the controlled area of the facility performing work for or in conjunction with the Contractor or utilizing Contractor facilities".

Final Safety Evaluation Report (DOE/RL-96-0006 [DOE-RL 1996b]). The document approved and issued by the Director of the Regulatory Unit that addresses the adequacy of the authorization basis for operation.

Graded Approach (10 CFR 830.3). A process by which the level of analysis, documentation, and actions necessary to comply with a requirement in this part (i.e., 10 CFR Part 830) are commensurate with:

1) Relative importance to safety, safeguards, and security
2) Magnitude of any hazard involved
3) Life cycle stage of a facility
4) Programmatic mission of a facility
5) Particular characteristics of a facility
6) Any other relevant factor

Hanford Site. A 1,450 km^2 reservation in southeast Washington State owned by the Federal Government. Established in 1943 as part of the Manhattan Project, the initial activity on the Hanford Site was to produce plutonium for use in nuclear weapons for the nation's defense. The Hanford Site has had nine production reactors and four chemical separation plants. The current mission on the Hanford Site is environmental cleanup and development of related technologies.

Hazard (DOE/RL-96-0006 [DOE-RL 1996b]). A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel, damage to an operation, or to the environment (without regard for the likelihood or credibility of accident scenarios or consequence mitigation).

Hazard and Operability Analysis (AIChE 1992). A systemic method in which process hazards and potential operating problems are identified using a series of guide words to investigate process deviations.

Hazardous Material. A solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health.

High-Level Waste (Contract, Section J, Attachment 9 [DOE-RL 1996c]). The highly radioactive waste material that results from the operation of the first-cycle solvent extraction system or equivalent and subsequent extraction cycles or equivalent that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

High Radiation Area (10 CFR 835). Any area, accessible to individuals, in which radiation levels could result in an individual receiving a deep dose equivalent in excess of 0.1 rem (0.001 sievert) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Highly Hazardous Chemical (DOE/RL-96-0006 [DOE-RL 1996b]). A substance possessing toxic, reactive, flammable, or explosive properties as defined by 29 CFR 1910.119.

Human Factors (AIChE 1992). A discipline concerned with designing machines, operations, and work environments to match human capabilities, limitations, and needs. Among human factors specialists, this general term includes any technical work (engineering, procedure writing, worker training, worker selection) related to the person in operator-machine systems.

Important-to-Safety (DOE/RL-96-0006 [DOE-RL 1996b]). Structures, systems, and components that serve to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the workers and the public. It encompasses the broad class of facility features addressed (not necessarily explicitly) in the top-level radiological, nuclear, and process safety standards and principles that contribute to the safe operation and protection of workers and the public during all phases and aspects of facility operations (i.e., normal operation as well as accident mitigation).

This definition includes not only those structures, systems, and components that perform safety functions and traditionally have been classified as safety class, safety-related or safety-grade, but also those that place frequent demands on or adversely affect the performance of safety functions if they fail or malfunction (i.e., support systems, subsystems, or components). Thus, these latter structures, systems, and components would be subject to applicable top-level radiological, nuclear, and process safety standards and principles to a degree commensurate with their contribution to risk. In applying this definition, it is recognized that during the early stages of the design effort all significant systems interactions may not be identified and only the traditional interpretation of important to safety (i.e., safety-related may be practical). However, as the design matures and results from risk assessments identify vulnerabilities resulting from non-safety-related equipment, additional structures, systems, and components should be considered for inclusion within this definition.

Independent Safety Review Team. A group of individuals with the demonstrated knowledge and expertise to confirm the completeness, credibility, and adequacy of the Project radiological, nuclear, process safety documents, and recommend their approval to the Project Manager.

Initial Safety Evaluation Report (DOE/RL-96-0006 [DOE-RL 1996b]). The document, approved and issued by the Director of the Regulatory Unit, that addresses the capability or potential for obtaining future authorizations for construction, operation, and deactivation.

Initiating Event (AIChE 1992). The first event in an event sequence. Can result in an accident unless engineered protection systems or human actions intervene to prevent or mitigate the accident.

Internal Event. An occurrence related to structure, system, and component performance or human action, or an occurrence external to the system but within the RPP-WTP that causes upset of a structure, system, or component.

Likelihood (AIChE 1992). A measure of the expected probability or frequency of an event's occurrence.

Limiting Conditions for Operations (DOE/RL-96-0006 [DOE-RL 1996b]). The lowest functional capability or performance level of equipment required for safe operation of the facility.

Low-Activity Waste (Contract, Section J, Attachment 9 [DOE-RL 1996c]). Low-level tank waste that has not yet received NRC concurrence as incidental.

Margin of Safety (DOE/RL-96-0006 [DOE-RL 1996b]). The level of confidence that is assigned to the integrity of radiological control measures such as confinement barriers. It is defined as the range between the design acceptance limits and the design failure point of the control feature. The design acceptance limits for radiological control measures such as confinement barriers are established during the design of the facility. These criteria are given in terms of those physical parameters that define their performance. Whenever the values of the design acceptance limits are exceeded, the margin of safety, and therefore the confidence in the integrity of the control feature, is decreased.

Major Accident. Relative to implementation of the incident investigation and reporting requirements of 29 CFR 1910.119(m), a major accident is a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals or radioactive materials, that presents serious danger to facility workers.

Mitigative Feature. A structure, system, component, or administrative control that serves to reduce the consequences of a hazardous situation or accident.

Normal Operation (DOE/RL-96-0006 [DOE-RL 1996b]). Steady-state operation and those departures from steady-state operation that are expected frequently or regularly in the course of facility operation, system testing, and maintenance. It includes conditions such as startup, shutdown, standby, anticipated operational occurrences, operation with specific equipment out of service as permitted by the approved operational constraints, and routine inspection, testing, and maintenance of components and systems during any of these conditions if it is consistent with the approved operational constraints.

Operations Risk Goal (DOE/RL-96-0006 [DOE-RL 1996b]). The risk, to the population (public and workers) in the area of the Contractor's facility, of cancer fatalities that might result from facility operation should not exceed one-tenth of one percent (0.1%) of the sum of cancer fatality risks to which members of the U.S. population generally are exposed.

By Footnote 13 to DOE/RL-09-0006, for evaluation purposes, individuals are assumed to be located within 10 miles of the controlled area.

Preventative Feature. A structure, system, component, or administrative control that serves to preclude the occurrence of a hazardous situation or accident.

Probabilistic Analysis. An approach to accident analysis that addresses all credible initiating events and that is risk-based in that it considers both the likelihood and consequences of accidents to determine overall risks. Mitigating system and component reliability as well as human performance are assessed probabilistically to support risk-informed decision making. The probabilistic analysis goes beyond the single failure requirements of the deterministic approach in that it assesses the probabilities of multiple failures. This is a "best-estimate" analysis in that realistic input and modeling assumptions are used and all of the available structures, systems, and components are considered that can prevent or mitigate the event. The evaluation of the availability and reliability of structures, systems, and components considers failure to start and failure to run as well as maintenance-caused unavailabilities.

Process (DOE/RL-96-0006 [DOE-RL 1996b]). Any activity involving a highly hazardous chemical including use, storage, manufacturing, handling, or the onsite movement of such chemicals, or a combination of these activities.

Process Hazards Analysis. The identification of hazards and the analysis of the significance of hazardous situations associated with a process or activity. It includes preliminary hazard analysis and Hazard and Operability Analysis (HAZOP).

Process Safety DOE/RL-96-0006 [DOE-RL 1996b]). The operation of facilities that handle, use, process, or store hazardous materials in a manner free of episodic or catastrophic incidents. However, the handling, use, processing, and storage of materials with inherent hazardous properties can never be done in the total absence of risk. Process safety is an ideal condition towards which one strives.

Process Safety Management DOE/RL-96-0006 [DOE-RL 1996b]). The application of management systems to the identification, understanding, and control of process hazards to prevent process-related injuries and incidents.

Public DOE/RL-96-0006 [DOE-RL 1996b]). Individuals who are not occupationally engaged at the Hanford Site.

Radiation Exposure. Radiation exposure, as used in Project documents, is the exposure of people (public, facility workers, collocated workers) to ionizing radiation produced by radioactive material. Unless otherwise specified, radiation exposure means the total effective dose equivalent (TEDE), that is, the sum of external and internal exposures. External exposures are assessed as the resulting effective dose equivalent; internal exposures as the resulting committed effective dose equivalent. Other terms used in Project documents, such as radiological exposure, dose, radiation dose, and the like, are taken as synonymous to radiation exposure.

Radiological, Nuclear, and Process Safety (Contract, Section J, Attachment 9 [DOE-RL 1996c]). Those actions taken to control the hazards incident to possession, use and disposal of radioactive and nuclear material, and the processing of hazardous chemicals.

Radiological Worker (10 CFR 835). A general employee whose job assignment involves operation of radiation-producing devices, or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 sievert) per year total effective dose equivalent (TEDE).

Regulatory Guides. Documents that describe methods acceptable to the U.S. Nuclear Regulatory Commission (NRC) staff for implementing specific portions of NRC regulations. Some regulatory guides lay out steps taken by the staff in evaluating specific situations. Others provide guidance to applicants concerning information needed by staff in its review of applications for permits and licenses, or refer to or endorse national standards.

Reportable Occurrence. An incident that shall be reported to the DOE incident reporting and process system and other federal or state agencies. The threshold for reporting will be provided in the RPP-WTP incident reporting procedure to be developed in Part B.

Requirements. Standards that are mandated by an authority through statute, regulations, and contract.

Restricted Area (DOE/RL-96-0006 [DOE-RL 1996b]). An area identified by the Contractor to which access is limited for the purposes of protecting individuals against undue risk from exposure to radiation and radioactive materials. Only a radiation worker is allowed into this area.

Risk (AIChE 1992). The combination of the expected frequency (events/year) and consequence (effects/event) of a single accident or a group of accidents.

Risk Assessment (AIChE 1992). The systematic application of management policies, procedures, and practices to the tasks of analyzing and controlling risk in order to protect employees, the general public, the environment, and company assets.

Safe State (DOE/RL-96-0006 [DOE-RL 1996b]). A situation in which the facility process has been rendered safe and no pressurized material flow occurs in the process lines. Any active, energy generating, process reactions are in controlled or passive equipment. The structures, systems, and components necessary to reach and maintain this condition are functioning in a stable manner, with all process parameters within normal safe state ranges.

Safety Analysis Report (DOE/RL-96-0006 [DOE-RL 1996b]). A document that fully describes the analyzed safety basis for the facility (safety envelope), fully demonstrates that the facility will perform and will be operated such that radiological, nuclear, and process safety requirements are met, and fully demonstrates adequate protection of the public, the workers, and the environment.

Safety Criterion. A measurable and/or demonstrable statement of an expected condition that ensures adequate protection of the public and workers. In satisfying the full set of Safety Criteria, the Project ensures that an acceptable status or condition protecting the public and/or workers has been achieved and/or maintained.

Safety Design Class. Structures, systems, or components that, by performing their specified safety function, prevent workers or the maximally exposed member of the public from receiving a radiological or chemical exposure that exceeds the accident exposure standards defined in the SRD. Those features credited for the prevention of a criticality event are also designated as Safety Design Class.

Safety Design Significant. Structures, systems, and components needed to achieve compliance with the radiological or chemical exposure standards for the public and workers during normal operation; and SSCs that can, if they fail or malfunction, place frequent demands on, or adversely affect the function of, Safety Design Class SSCs.

Safety Limits (DOE/RL-96-0006 [DOE-RL 1996b]). Limits on process variables associated with those physical barriers, generally passive, that are necessary for the intended facility safety functions and that are found to be required to prevent release of unacceptable levels of radioactive material to workers or the general public.

Specified Safety Function. That attribute of a Safety Design Class or Safety Design Significant engineered control credited for maintaining public or worker safety within exposure standards.

Safety Requirements Document (SRD)(DOE/RL-96-0006 [DOE-RL 1996b]). A document that contains the approved and mandated set of radiological, nuclear, and process safety standards and requirements which, if implemented, provides adequate protection of workers, the public, and the environment against the hazards associated with the operation of the Contractor's facilities.

Start of Cold-Testing. That point in the construction phase of each facility of the RPP-WTP during start-up testing but prior to admitting any significant quantities of radioactive waste or process chemicals into the facility. This milestone will be established in the Construction Agreement.

Tailoring (DOE G 450.4-1). Adapting something, such as a safety program, practice, or requirement to suit the need or purposes of a particular operation or activity, taking into account the type of work and associated hazards and hazardous situations.

Technical Safety Requirements (DOE/RL-96-0006 [DOE-RL 1996b]). Those requirements that define the conditions, the safe boundaries, and the management or administrative controls necessary to ensure the safe operation of the facility, reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials, and from radiation exposures due to inadvertent criticality.

Unreviewed Safety Question (USQ) (DOE/RL-96-0006 [DOE-RL 1996b]). A safety question where any of the following conditions are satisfied: 1) the probability of occurrence or the radiological consequences of an accident or malfunction of equipment important to safety, previously evaluated in the facility safety analyses or other related safety analysis and evaluations not yet included in the updated facility analysis, may be increased; 2) a possibility for an accident or equipment malfunction of a different type than any evaluated previously in the facility safety analyses or other related safety analysis and evaluations not yet included in the updated facility safety analysis may be created; or 3) any margin of safety is reduced. (Also see definition for “Margin of Safety”.)

Validation. As applied to procedures, validation is the process that ensures an administrative control provides sufficient and understandable guidance and direction to the craft person and that it is compatible with the equipment or system being maintained. Validation is typically performed in the field prior to initial procedure use.

Verification. As applied to procedures, verification is the review to ensure the proper format and technical accuracy of a new or revised procedure. This review also ensures that the format incorporates human factors principles and other appropriate administrative policies.

Worker (DOE/RL-96-0006 [DOE-RL 1996b]). Worker means an individual within the controlled area of the facility performing work for or in conjunction with the Contractor or utilizing Contractor facilities.

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